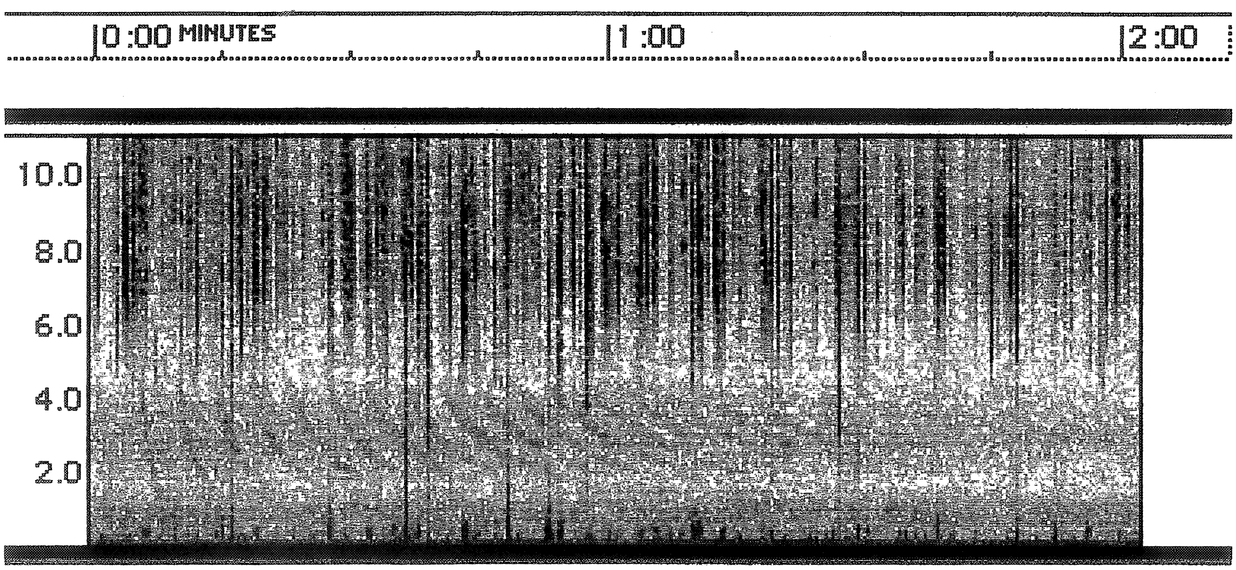
# The INSPIRE Journal

Volume 8 Number 2

April 2000

## A Whistler and Its Echo...Echo...Echo...Echo...




.Shawn Korgan of Gilcrest, Colorado, recorded this whistler and its many echoes during the Coordinated Observations on November 21, 1999. The whistler is at the left and the echoes continue for more than two minutes. There are 26 echoes on this view as they slowly fade away. See more details on Page 10 inside!

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The INSPIRE Journal

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*The INSPIRE Journal* is a publication of The INSPIRE Project, Inc., a nonprofit educational/scientific corporation of the State of California. The purpose of the INSPIRE Project, Inc., is to promote and support the involvement of students in space science research. All officers and directors of the corporation serve as volunteers with no financial compensation. The INSPIRE Project, Inc., has received both federal and state tax-exempt status (FEIN 95-4418628). The *Journal* is published two times per year: November 1 and April 1. Submission deadlines: October 1 and March 1



Contributions to the *Journal* may be sent to:

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Chaffey High School
1245 N. Euclid Avenue
Ontario, CA 91762

email: pine@mail630.gsfc.nasa.gov
billpine@earthlink.net
Fax: 909 931 0392

## Sounds from the *Journal* to be Available on the Website!

Check the INSPIRE website for audio files of some of VLF signals described in this issue. The URL is:

http://image.gsfc.nasa.gov/poetry/inspire

Select the "Journal" button on the home page and then select "Audio Samples". The amazing echo train will be one of the files available. We hope this new feature will help bring the *Journal* to life.

## Write for *The INSPIRE Journal*

The procedure for contributing articles for *The INSPIRE Journal* could not be simpler! Just send it in! Any format is acceptable. Electronic format is easier to work with: a Word file on disk for either the PC or Mac platform. An email message will work, too. If that does not work for you, a paper copy will do. Any diagrams or figures can be scanned in.

What about topics? Anything that interests you will probably interest most INSPIRE participants. As long as the topic is related to natural radio or the equipment used, it will get printed. The deadlines for submissions are March 1 for the spring edition and October 1 for the fall edition. Don't worry about the deadlines, though. If you miss a deadline, you will just be very early for the next edition!

We at INSPIRE are looking forward to hearing from you.

## New email Addresses for the *Journal*

The editor of The INSPIRE Journal can now be reached at th following email addresses:

pine@mail630.gsfc.nasa.gov
billpine@earthlink.net

## Subscription Information Included on the Address Label

You can determine the status of your subscription to *The INSPIRE Journal* by looking at the address label. In the upper right corner of the label is a 2-digit number that indicates the year your subscription will expire. All subscriptions expire with the November issue. If your label shows "00", then the next issue will be the last under this subscription. If your label shows "01", then your subscription is good through the November 2001 issue. If you have any questions or if you feel that the information shown is incorrect, please contact the editor.

# INTMINS-April/2000 Operations Schedule

By Bill Taylor, Washington, DC
Stas Klimov, Moscow, Russia
Bill Pine, Ontario, CA

The April/2000 INTMINS Operations schedule will be finalized soon. Operations will occur on the last two weekends: April 22-23 and April 29-30. Data gathered will be analyzed and reported on in the November 2000 issue of *The INSPIRE Journal.*

## Gathering Data:

IMPORTANT NOTE: Data gathering procedures will remain the same as those used since April 1996.

Perhaps the most important ingredient in a successful data gathering session is what happens **before** you go out in the field. The following is the recommended procedure for data gathering including preparation prior to the date of the operation.

Step 0: Completely check out all equipment. A good method is to set up everything in your living room. All you will hear is household 60 Hz, but you will know the equipment is working. This is also a good time to fill out the log cover sheet (see Page 52 of the *Journal*).

Step 1: Define "T-time" as the starting time for operation of ISTOCHNIK.
Convert the UT time to local time.
Arrive at your site with time to spare.

Step 2: Start data recording at T minus 12 minutes.
Prior to this time place a brief voice introduction on the tape identifying the observers and the operation number.

Step 3: Place time marks on the tape at: T-12, T-10, T-5, T, T+3, T+8, T+13, and near the end of the tape. Use UTC times only. Note that this schedule brackets the scheduled time of operation of ISTOCHNIK with time marks. Use 60 minute tapes and place one operation per side.

Step 4: Keep a written log (see Page 53 of the *Journal*) of time marks and descriptions of everything you hear.

Step 5: Review your tapes and revise your logs if necessary.

Step 6: Mail your tapes and logs to Bill Pine at the address shown on Page 2 of the *Journal.*
Your tapes will be returned to you.
Send in copies of your logs since they will not be returned.
You will receive a copy of the spectrograms made from your data.
Your data will be incorporated in the data analysis report article in the *Journal.*

## Mode of Operation:

The two instruments on MIR are Ariel and ISTOCHNIK. Ariel is a plasma generator and operates for 5 minutes, alternating between axes. ISTOCHNIK is a modulated electron gun that accelerates a beam of electrons and emits them into space. The electron beam is turned on and off at frequencies of either 10 hertz or 1000 hertz (1 kHz), which should cause the radiation of electromagnetic waves in the VLF range at those two frequencies. ISTOCHNIK operates for a total of 2 minutes on the following schedule:

| | |
|---|---|
| ISTOCHNIK mode: | 10 seconds modulate at 10 Hz |
| | 10 seconds modulate at 1000 Hz |
| | 10 seconds modulate at 10 Hz |
| | 10 seconds modulate at 1000 Hz |
| | repeat for 2 minutes of operation |

On each pass, Ariel will either operate first or last, whichever gives the most coverage over INTMINS observers. Since the signal from ISTOCHNIK is more powerful, it is the one most likely to be detected. For that reason, the schedule emphasizes the operation of ISTOCHNIK.

## Notes on Time Marks and Logging;

The purpose of putting time marks on the data tapes is twofold:

1. The obvious need to know what time is represented in each part of the tape,

2. also to provide a means of synchronizing the tape with actual time. Battery operated recorders tend to run slower as the batteries wear out. Some recorders run fast or slow because of the particular motor being used. By timing (with a stopwatch) the actual times between time marks, the speed of the analysis recorder can be adjusted to synchronize the data tape with actual time. This has the effect of adjusting the frequencies on the spectrogram to the proper values since incorrect tape speed on the data recorder will cause the frequencies to be out of position.

When time marks are put on the tape, they should include an announcement of the UT time and a mark (either by voice ("mark") or by WWV tone or some other means). Try to minimize the interruption to the data flow when putting on the time marks. This takes practice! Also, put the time marks on at least as often as is called for by the instructions. It is better to have more time marks than are called for than to have too few.

The purpose of the data log is to record the contents of the tape. The time of each time mark should be recorded. Anything else of interest should be noted on the log with the time indicated.

Tapes with incomplete or missing time marks and poor logs are nearly impossible to analyze. Your help in following good time mark and logging procedures is much appreciated.

# INTMINS Schedule

**The operation schedule had not been determined by press time. The schedule will be printed separately and mailed included with the *Journal*.**

# Coordinated Observation Schedule
# April/2000

By Bill Pine Ontario, CA

In response to requests in the INSPIRE Survey for observation opportunities at more convenient times, the INSPIRE Coordinated Observation Program was established in April/98 in conjunction with the INTMINS observations. The purpose of the coordinated observations is to provide an opportunity for INSPIRE observers to make recordings of natural VLF radio and to compare the resulting data. Ideally, a coordinated session would result in everyone hearing whistlers. While coordinated observations in November revealed mostly quiet natural VLF conditions, some whistlers were heard along with tweeks and chorus. (See "Report on Coordinated Observations 11/99" on Page 34 in this issue of *The INSPIRE Journal*.)

The procedure to use for coordinated observations will be as follows:

1. Use the Data Cover Sheet and Data Log as with the INTMINS observations.
2. Record for 12 minutes at the start of each hour that you can monitor on the specified days. Keep a detailed log of all signals that you hear and indicate any items of interest. When you submit your tapes, spectrograms will be made of any parts of the tape that you indicate.
3. Place a time mark on the tape on the hour and each two minutes for the next 12 minutes. Use Coordinated Universal Time (UTC) for all time marks.
4. Record at 8 AM and 9 AM **LOCAL** time.
5. In addition, record on other hours to compare results with those in neighboring time zones. For example, an observer in the Central Time Zone might record at 7 AM (8 AM EDT), at 8 and 9 AM CDT and at 10 AM (9 AM MDT).
6. Use 60 minute tapes (30 minutes per side) with two sessions per side. It is preferred that you record on one side of the audio tape only.
7. Label all tapes and logs to indicate the sessions monitored and send to:

   Bill Pine
   Chaffey High School
   1245 N. Euclid Avenue
   Ontario, CA 91762

8. Your tapes will be returned with spectrograms of your data. An article reporting on the results will appear in the next *Journal*. .
9. SPECIAL NOTE: If you are hearing whistlers, replace the data tape after 12 minutes with a "Whistler" tape and continue recording with time marks every two minutes. If we get whistlers, this would be a good opportunity to try to determine the "footprint" of a whistler (the "footprint" is the geographical area where a whistler can be detected).

**Specified Coordinated Observation Dates for April/2000:**

**Saturday, April 29 and Sunday, April 30**

*The following article appeared in Volume 5 Number 1, November 1996*

# Recording Alone:

## Learning From Experiences Recording INTMINS Sessions

Mike F. Aiello
Croton, NY 10520

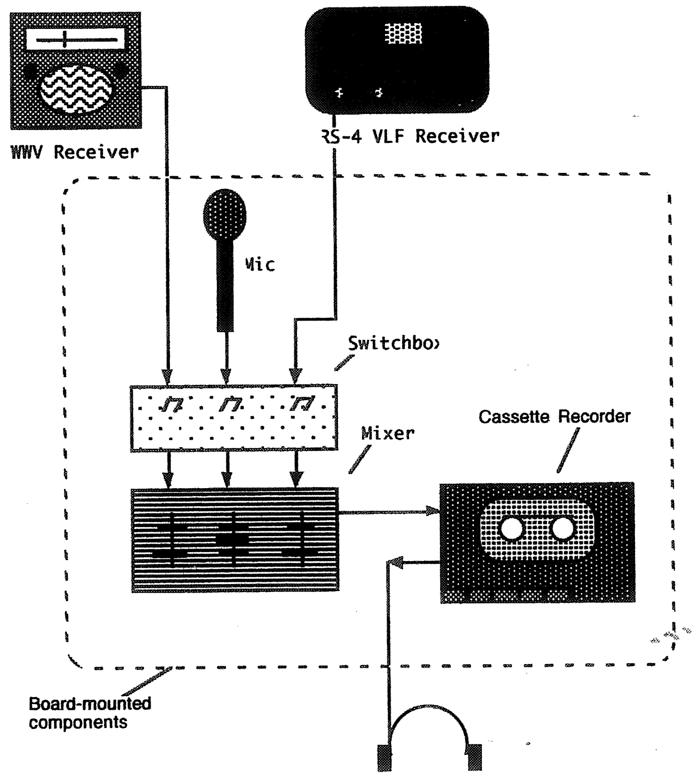
Since my first experience as one of many ground observers in the SEPAC experiments, I have found participating in an organized effort to collect scientific data both exciting and rewarding. There is a challenge to meeting a schedule, in the field, working with a fairly complex assortment of gear and a time-dependent protocol. This challenge is especially keen when you are working in pitch darkness, outdoors, in below freezing temperatures, alone, and at 2:03 AM local time on a weekday. (For some reason, these seem to be the only passes I can cover here on the East Coast...)

Not that VLF data collection is that difficult a process, but with at least four main components, (radio, VLF receiver, microphone, and cassette recorder), the need to set up antennas, make voice announcements on cue, etc., there is enough going on to make the whole process easy prey to Murphy, or just plain late night befuddlement. This is not to mention the 2n interconnections that must be made correctly, with good contact. And then there are batteries...

After many on-site mishaps and nearly missed schedules, I came up with two improvements for my recording sessions: one involving the hardware and one involving the process. These are both simple ideas, but I thought they were worth sharing, because the improvement in field operation that resulted was dramatic. You may already be doing similar things; I would welcome any correspondence on ideas you've developed in the field. The key to the hardware improvement was to eliminate poor/incorrect interconnections by making most of them permanent. Now the equipment I use for VLF recording has other responsibilities in real life, so a hard-wired, permanent fixture wouldn't do. Instead, I found a medium sized composition drawing board at a local art supply store, and came up with secure, but removable, means of mounting my recording equipment on the board. Large pieces of equipment are attached using lengths of bungie cord passed through holes in the board and knotted behind. The smaller items are affixed with self-adhesive Velcro™ patches. The board itself had a convenient handle hole, making the whole affair easily portable. The board contains four items attached to it: the cassette recorder, a four-channel mixer, a homemade switch box for three audio channels, and a gooseneck that holds my microphone for voice announcements. There are only three off-board connections that must be made on-site: audio from the WWV receiver, audio from the VLF receiver, and my headphones. All other connections are made on the board beforehand, and are as short as possible. There is no possibility of tangles, dislodged or loose connections between the on-board components. You can see this layout in the accompanying block diagram.

The switch box is an extra convenience that I added to facilitate night work. Each switch is paired with an indicator LED that lights when that channel is enabled. Not only is this visual cue very handy, but the switches allow me to add in and drop out WWV and the microphone without changing the pre-set recording levels determined before the session. The whole audio mixing board is very secure and easy to transport and use. There's even a spot to clip a digital clock displaying UT.

VLF Field Recording Station
Block Diagram




The process of improvement took the form of a comprehensive set of checklists (on the next page) that record every setting and every connection necessary to complete the session. The settings include switch settings on the VLF receiver, and recording levels on the mixer and the cassette recorder. The WWV frequency, and radio volume and tone are also included. The interconnection checklist covers all the connection points in the system, including those on the board. You can see samples of the checklists at the end of the article. I use the checklists at two points in the recording session. Well before the start of the session, I set recording levels and select the WWV frequency I'll use. I record this information on the checklist at the appropriate places. After I have made all the necessary settings, I make all the connections between the board and the other components, and the VLF receiver and the antenna system. Just before the start of the session, I run over the checklist one last time, verifying each connection or setting. If I follow this procedure faithfully, I am set and ready when the recording start time arrives.

The audio board had its pilot run during the November 1995 INTMINS series. I only managed one session, and although the board components functioned well, I had battery trouble (figures...) and nearly missed the schedule. In the April session, I added the checklists and fresh batteries, and the session came off flawlessly. It was a warm, sunny late afternoon recording session, but I'm sure that had nothing at all to do with the successful run. In any event, by organizing the connections, and the set-up process, fortune has to be smiling just a little bit more on my recording efforts in the field.

## VLF Recording Session Checklist 1 of 2

**Board Hookups**

- [ ] WWV: Radio(Tape Out)-->Mixer(Channel 1 Mic)
- [ ] Mic: -->Mixer(Channel 2 Mic)
- [ ] VLF: RS-4(Rcvr Out)-->Mixer(Channel 3 Mic)
- [ ] Phones: -->CTR(Phones)
- [ ] Audio Mixer(Left Out)->CTR(Mic In)
- [ ] Clock: Clip to board

**RS-4 Hookups**

- [ ] Ant: RS-4(Ant. In)-->Antenna Pigtail
- [ ] Gnd: RS-4(Gnd. In)-->Ground Strap (to car)

**RS-4 Settings**

- [ ] Level: 1 2 3 4 5 6
- [ ] Antenna: ___ Whip / ___ Long Wire
- [ ] Output ___ Rcvr / ___ Mic
- [ ] Filter: ___ In / ___ Out
- [ ] Power: ___ On / Off

## VLF Recording Session Checklist 2 of 2

**CTR Settings**

- [ ] Level 1 2 3 4 5 6 7 8 9 10
- [ ] Tone 1 2 3 4 5 6 7 8 9 10
- [ ] Vox: ___ Out / ___ Lo / ___ Hi
- [ ] ALC ___ Out / ___ In
- [ ] Counter 000

**Mixer Settings**

- [ ] WWV: Channel 1 2 3 Level 1 2 3 4 5 6 7 8 9 10
- [ ] Mic: Channel 1 2 3 Level 1 2 3 4 5 6 7 8 9 10
- [ ] VLF: Channel 1 2 3 Level 1 2 3 4 5 6 7 8 9 10
- [ ] Output: ___ Mono / Stereo
- [ ] Power ___ On / Off

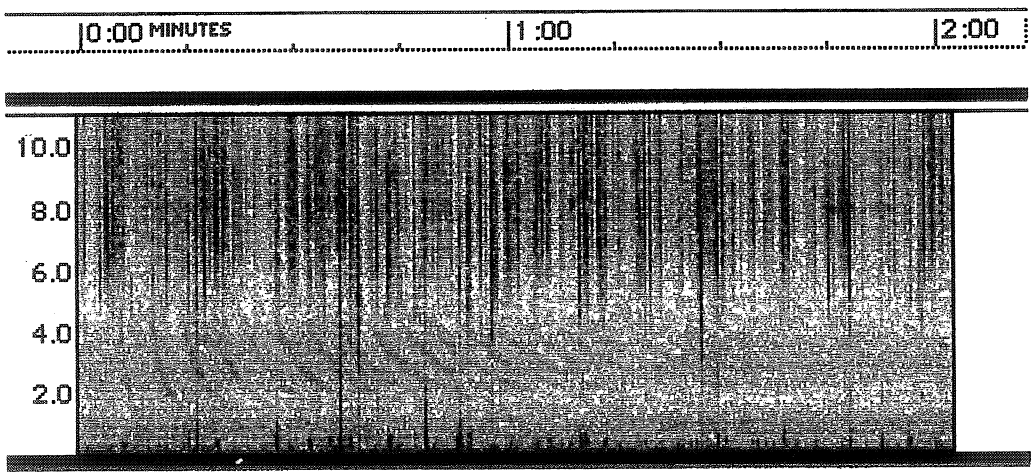
**WWV Radio Settings**

- [ ] Freq ___ 5000 / ___ 10000 / ___ 15000 / ___ 20000 kHz
- [ ] Base ___ 0 (Neutral)
- [ ] Treble ___ 0 (Neutral)
- [ ] Volume ___ 0 (Off)
- [ ] Mode ___ AM / FM / SSB
- [ ] Power ___ On / Off

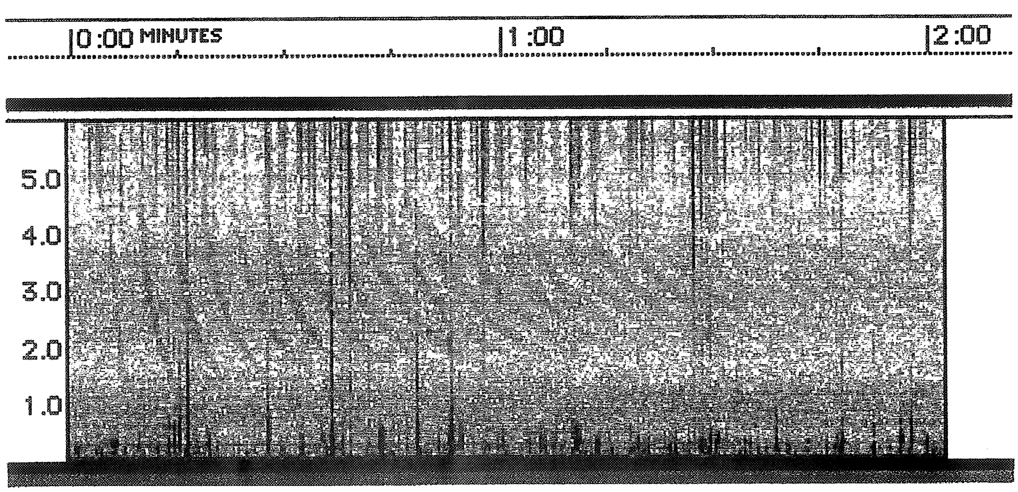
# An Amazing Whistler Echo Train

Whistler Recorded by Shawn Korgan, Gilcrest, CO
Commentary by Bill Pine, Ontario, CA

During the Coordinated Observations of November/99, Shawn Korgan was observing from a dirt road on the open prairie four miles from power lines. This is a very quiet site and Shawn observes using a very hot homemade receiver he calls the SK-1. At 13:03:35 UT (6:03:35 MST) he logged "Long whistler begins". At 13:05:00 UT he logged "Can still hear the above whistler". In the margin of the log sheet he noted "Lasted almost two minutes in duration! There were a lot of these whistlers before 6 AM while I was setting up my equipment." Below is a spectrogram of the two minutes starting at 13:03:20 UT.

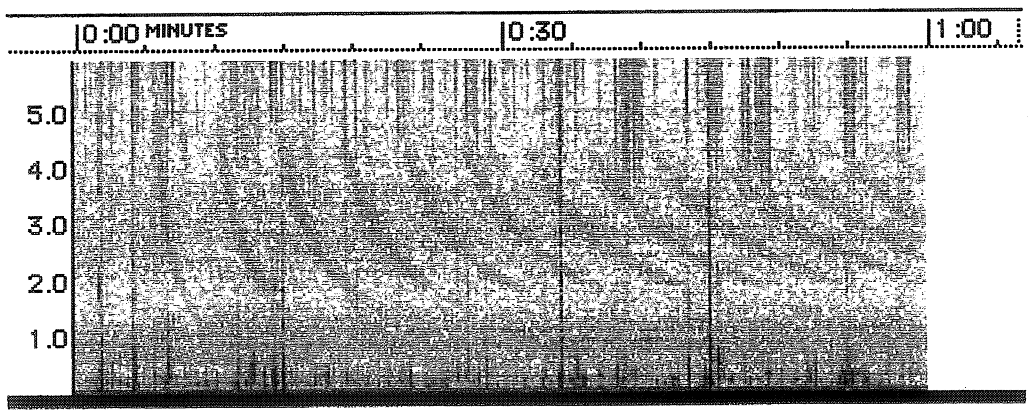



What Shawn captured is the longest whistler echo train I have ever heard of. Usually when you hear echoes, you hear one or two. Rarely do you hear more than a few and the echoes fade away rapidly. This whistler was not a particularly strong one and the echoes do not fade in intensity very fast. It kind of makes you wonder where the energy is coming from to provide so many echoes. Using a smaller frequency range (0-6 kHz) makes the echoes easier to see.

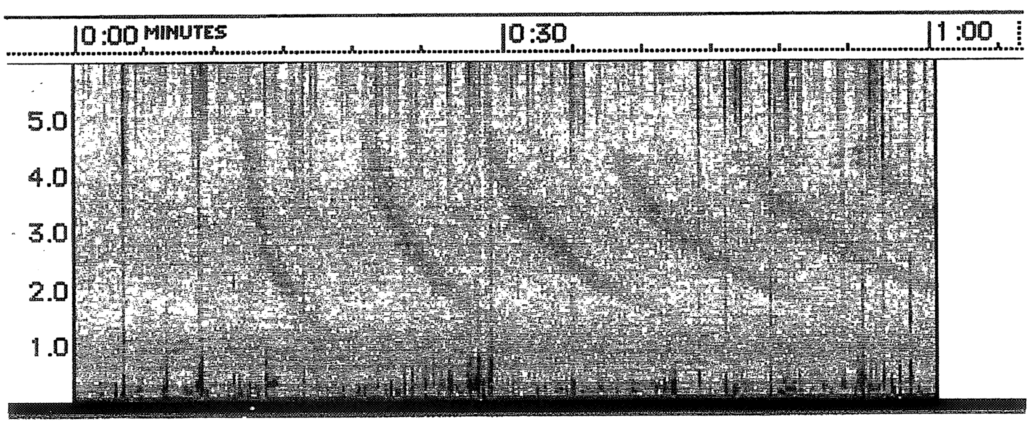


I remember seeing an article in a scientific journal years ago that showed the spectrogram of a whistler and its numerous echoes. One of the points made was that the number of echoes was surprisingly large. The number of echoes shown was eleven!

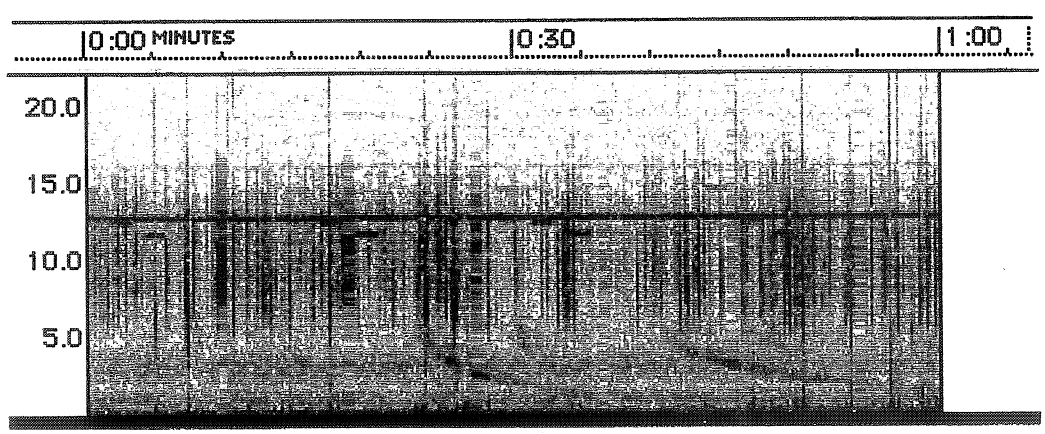
The next view is of the first minute of the segment.




Next is a view of the first 30 seconds.




Notice the continuos decrease in slope for successive echoes. Finally, here is a spectrogram of the first 25 seconds using a 0-22 kHz frequency range.

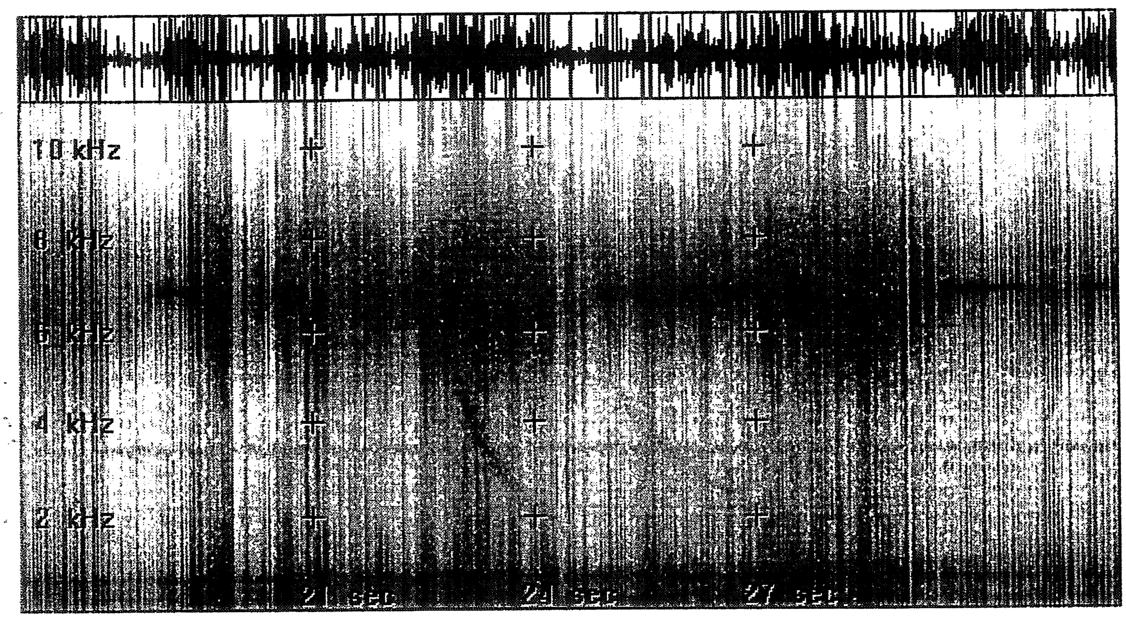



Notice the presence of Alpha dashes and a 13 kHz manmade line and the almost total absence of powerline hum. To properly display this amazing find, *The INSPIRE Journal* is introducing the first ever foldout – "An Amazing Echo Train"!

# Using a Graphing Calculator to Analyze Whistler Echoes

By Mark Spencer, Coleville, CA

Whistlers that arrive in pairs are candidates for consideration as echoes. They might, however, be independent whistlers that happened to arrive close together. The following spectrogram shows two such whistlers that arrived about three seconds apart.

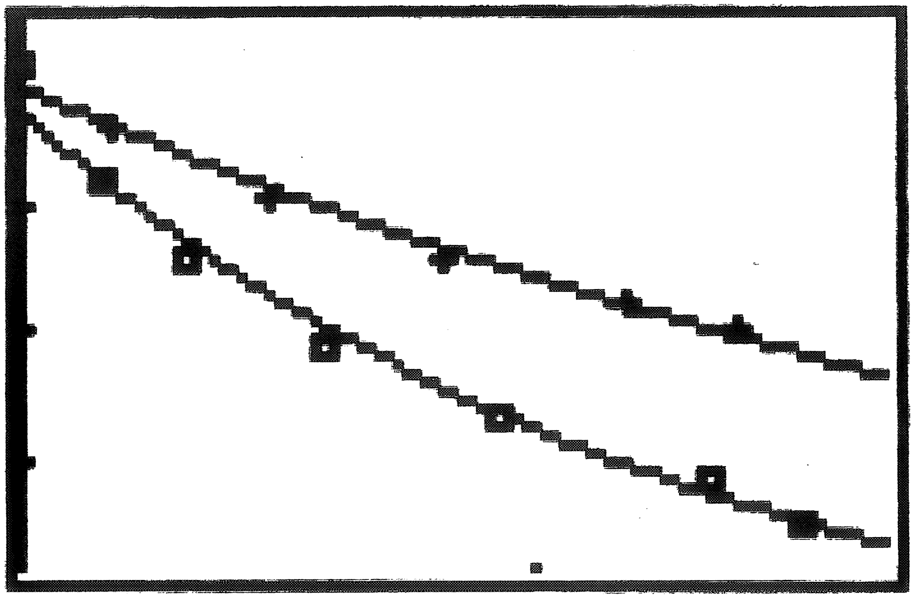



Spectrogram made using GRAM software for the PC.

One observation that can be made is that the whistlers do not have exactly the same shape or intensity. The second is a less steep curve and has a lower intensity. This relationship makes the second appear to be an echo of the first. To test this supposition I did the following:

1. I pulled off as many points (time and frequency values) from each curve as I could. The GRAM software has a feature that allows you to move the cursor to any point on the spectrogram and read the coordinates of that point.
2. I put the data into TI graphing calculator lists to plot the data and do some curve fitting.
3. Using the calculator functions, I determined the slopes of the individual curves for comparison.

The resulting graphs are shown on the next page. The result of the analysis is that the slope of the second curve is one half of the slope of the first, within the tolerance of the data taken from the spectrograms. I did a similar analysis on other whistlers on this mission and others and each time the whistlers from the same session had the same slopes.



Graph from a TI graphing calculator. The whistler is at the bottom, the echo is the top graph.

This analysis raises some questions:

1. Is there an algorithm that describes the speed versus frequency relationship through different media for VLF waves?

2. Can the above algorithm be used to determine the distance of travel of a signal based on the slope and length of a whistler in relation to the frequency?

# What is LoScrittoio.it and Why Does it Exist?

**By Flavio Gori, Florence ITALY**
**INSPIRE European Coordinator**

**LoScrittoio.it** is an old project of mine as a web magazine that a small group of friends is helping to become a reality. We like to read and write about investigative science, each of us in a specific field of research. We decided to write some pages every month and put them on **LoScrittoio.it**. In few days it will appear on the web at: **http://www.loscrittoio.it**

Who we are?

- **Flavio Gori** is an Inspire Project member since 1992, as well as Inspire Journal contributor, he will hold the Publisher/Editor position, beyond writing about the Very Low Frequency subject;

- **Veronica Capasso** is a Journalist for an important daily newspaper here in Italy. She'll write about Archeology, her great interest;

- **Stefano Ceccatelli** is a teacher of Philosophy and will tell us about the Philosophy of Science;

- **Federica Donati** is an English language teacher. She, too, is interested to Astronomy and moreover, she'll be extremely useful translating information from English to Italian, as well as keeping good contact with researchers, journalists, students and teachers from all over the world, who share the same ideas working over the same subjects.

- **Laura Gori** is a Mathematics and Astronomy teacher and will write about the those subjects;

**LoScrittoio.it** is dedicated to good science, or what we feel is good science, the Galileian one. We'd like write about the basics of science: not too high level (only a few people can understand and they don't need us to know their subjects), or too low (many journals are dedicated to the low end, while people who read these can't really understand if what they are reading is true or not). Moreover we'll write about the history of some subjects (i.e. math), the way they have developed, if they have had any alternatives, why they were refused or why they were accepted (at all or in part).

All of us will write about professional and amateur research. Especially when they are working together, as the **Inspire Project** has demonstrated, can be done. This kind of research, made in a serious and correct way, may drive research to important results, also in some new point of view, not the same as the classical system, though starting from very strong scientific base.

We also think that usual phenomenon, that happen every day, may appear as normal for people not involved in any way in the scientific research, though the same people may not be able to explain anything about it. So we decided to offer web space to these areas too: talk about normal phenomenon that "nobody" can say why and how they are. Just one simple example: why winter is colder than summer (in northern hemisphere, while on the contrary in the southern one)?

Philosophy of the science is with us because we believe that it can still bring a very important help to the scientific and technical subjects, as happened in the first 30 years of the last century. Physics has many thanks to say to Philosophy. In the same way we like to say a warm welcome to Archeology because we don't want to forget where we come from and what our grandfathers have made before to arrive at the present (how our technology have changed during millions of years). At the same time we'd like to understand if all of our tech-history is clear for sure, in the scientific way, or maybe something needs to be studied in a deeper way, in our past not only in the present and future.

An important thing to emphasize: journalists should not give solutions to their readers before explaining the problems. Too often in newspapers and general magazine, we read about great solutions to problems that nobody realizes we have. These solutions at no cost are useful to nobody. It should be right to inform nonscientist readers about what is going on, otherwise who needs the solution if no one knows there is a problem?

Beyond the contributors as said before, we hope there will be with us a larger group of researchers, worldwide, in our fields as well as in different ones, who would like to be part of our project, in an occasional way. We Inspire members will write for **LoScrittoio.it** many times per year, as I hope that some of our articles may appear in the Inspire Journal, both in paper and on the web. In the same way, the Inspire Journal might exchange links with LoScrittoio.it to give European visibility for its contributor and their ideas.

So we'd love to produce a serious magazine on the web. A "web paper" that informs and urges reflections in a calm way, designed for serious people. We hope to find people who are able to produce very strong intellectual battles, without losing human respect for themselves or for the other people, who may not have the same opinion. The human concept of respect has to be our base, especially in these days, when it seems to be an optional way for too many people living in the real world. We don't want disrespect to happen in the virtual world either.

# Renato Romero's VLF Web Page

Renato Romero, Cumiana, ITALY
http://web.tiscalinet.it/vlfradio/

IK1QFK - HOME Page    Exploring ULF-ELF and VLF radio band

## RADIO WAVES below 22 kHz

Those weird signals: Nature Radio Signals and strange emissions at very low frequency.
The first WEB OPEN LAB, on the Long Wave topic.
Read OPEN LAB rules and give your free collaboration to this experience!

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| ✦ UNEXPLAINED ULF/ELF SIGNALS | By IK1QFK | (shortly) |
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| ✦ LATEST NEWS on VLF activity, Message board | By IK1QFK | (upd. 27/02/00) |

Send your comments to the author: reromero@tin.it
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# INTMINS OBSERVERS

## Roster Update

The following is a roster of INTMINS observers including first-time observers. Team number assignments are permanent and will be used to refer to teams in the future. (Unless noted otherwise, all longitudes are West and latitudes are North.)

| Team # | Observer | Location | Longitude/Latitude |
|---|---|---|---|
| 1 | John Lamb, Jr. | Belton, TX | 97° 27' 50" / 31° 7' 45" |
| | University of Mary Hardin-Baylor | | |
| 2 | Stephen G. Davis | Fort Edwards, NY | 73° 29' 30" / 43° 18' 00" |
| 3 | Don Shockey | Oklahoma City, OK | 97° 40' 5" / 35° 43' 30" |
| 4 | Mike Aiello | Croton, NY | 73° 46' 45" / 40° |
| 5 | Jean-Claude Touzin | St. VitalQuebec | 79° 10' / 48° 55' |
| 6 | Bill Pine | Ontario, CA | 117° 41' / 34° 14' |
| | Chaffey High School | | |
| 7 | Dean Knight | Sonoma, CA | 122° 33Õ / 38° 21Õ |
| | Sonoma Valley High School | | |
| 8 | Mike Dormann | Seattle, WA | 123.4°/47.2° |
| 9 | Robert Moloch | Greentown, IN | 85° 58Õ / 40° 28Õ |
| | Eastern Elementary School | | |
| 10 | Bill Taylor | Washington, DC | 77° 2Õ / 38° 54Õ |
| | INSPIRE | | |
| 11 | Mark Mueller | Brown Deer, WI | 87° 56' / 43° 10' |
| | Brown Deer High School | | |
| 12 | Jon Wallace | Litchfield, CT | 73° 15' / 41° 45' |
| 13 | Bill Combs | Crawfordsville, IN | 86° 59' / 40° 4' |
| 14 | John Barry | West Lebanon, IN | 87° 22' / 40° 18' |
| | Seeger High School | | |
| 15 | Robert Bennett | Las Cruces, NM | 106° 44' / 32° 36' |
| 16 | Leonard Marraccini | Finleyville, PA | 80° 00' / 40° 16' |
| 17 | Kent Gardner | Fullerton, CA | 117° 48' 30" / 34° 12' 13" |
| 18 | David Jones | Columbus, GA | 77° 07' / 35° 00' |
| 19 | Larry Kramer / Clifton Lasky | Fresno, CA | 119° 49' / 37° 01' |
| 20 | Barry S. Riehle | Cincinnati, OH | 84° 15' / 39° 7' |
| | Turpin High School | | |
| 21 | Phil Hartzell | Aurora, NE | 98° 0' / 41° 0' |
| 22 | Rick Campbell | Brighton, MI | 83°50'2.7" / 42°16'43.7" |

| | | | |
|---|---|---|---|
| 23 | Jim Ericson | Glacier, WA | 121° 57.91' / 48° 53.57' |
| 24 | Paul DeVoe | Redlands, CA | 116° 52' / 34° 10' |
| | Redlands High School | | |
| 25 | Norm Anderson | Cedar Falls, IA | 92° 15' / 42° 20' |
| 26 | Brian Page | Lawrenceville, GA | 83° 45' / 34° 45' |
| 27 | Ron Janetzke | San Antonio, TX | 98° 47' / 29° 35' |
| 28 | Thomas Earnest | San Angelo, TX | 100° 25' / 31° 16' |
| 29 | Janet Lowry | Houston, TX | 95° / 29° |
| 30 | Linden Lundback | Watrous, Sask, | 105° 22' / 51° 41' |
| 31 | Lee Benson | Indianapolis, IN | 86° 3' / 39° 23' |
| 32 | Shawn Korgan | Gilcrest, CO | 104° 67' / 40° 22' |

**European observers:**

| Team # | Observer | Location | Longitude/Latitude |
|---|---|---|---|
| E1 | Flavio Gori | Florence, IT | 11° 50Õ 18Ó E/ 43° 50Õ 18Ó N |
| E2 | Silvio Bernocco | Torino, IT | 7° 12Õ E / 44° 54Õ N |
| E3 | Fabio Courmoz | Aosta, IT | 7.7° E / 45.7° N |
| E4 | Joe Banks | London, UK | 0° / 50° 52Õ N |
| E5 | Renato Romero | Cumiana, IT | 7° 24Õ E / 49° 57Õ N |
| E6 | Marco Ibridi | Finale E., IT | 11° 17' E / 44° 50' N |
| E7 | Alessandro Arrighi | Firenze, IT | 10° 57' 50" E / 43° 43' 21" N |
| E8 | Zeljko Andreic | Zagreb, Croatia | |
| | Rudjer Boskovic Institute | | |
| E9 | Dr. Valery Korepanov | Lviv, UKRAINE | 24° E / 50° N |
| | Lviv Center of Institute of Space Research of NASU | | |
| E10 | Sarah Dunkin | London, England | 0° 02' E / 51° 40' N |
| | University College London | | |

# INTMINS - November/99 Data Analysis Report

by Bill Pine
Chaffey High School
Ontario, CA

The November/99 INTMINS observations marked the tenth session in an ongoing series of operations conducted with the cooperation and assistance of the Russian Space Agency (IKI) and ENERGIA, the Russian space engineering organization. INTMINS is an attempt to detect manmade VLF radio waves emitted by instruments on the MIR Space Station.

## INTMINS Status Report

Because the MIR space Station was unmanned last fall, operations could only be scheduled for parts of the orbit near Russia. This allowed operation of the electron gun only over Europe and the Western United States. A reduced schedule of operations was planned with this constraint in mind. The orbit was stable enough to allow the schedule to be conducted without alteration.

The bottom line of the analysis remains unchanged: the VLF signal from the pulsed electron beam was not detected on the ground. This is not an unsurprising result since theoretical calculations of the signal of the power of ISTOCHNIK when propagated to the ground place the signal strength at just about the same as the background of natural VLF. We will continue with INTMINS as long as the Russian Space Agency (IKI) and MIR are able to provide observing opportunities for us. It is beginning to look like (even to an optimist!) the beam strength of ISTOCHNIK is inadequate to propagate a VLF signal to the ground that can be detected by our receivers. In the future, perhaps on the International Space Station, maybe a more powerful electron gun will be available for us to use in this ongoing investigation.

## Data Analysis Procedure

The data analysis procedure used consisted of the following:

1. A sound file was created of the 2-minute period of ISTOCHNIK operation.

2. A spectrogram image was made of this file using a frequency range of 0-22.05 kilohertz so that the 12-15 kilohertz range could be examined for the presence of Russian Alpha navigation signals. The 1 kilohertz region of the spectrogram was examined for the 10 seconds on, 10 seconds off signal from ISTOCHNIK.

3. A one-minute portion of the file was cropped, enlarged and an image made using a 0-11.025 kilohertz frequency range. Again the 1 kilohertz region of the spectrograph was examined.

4. Finally, a 30-second portion was cropped, enlarged and an image made. A final examination of the 1 kilohertz region was made.

5. Additional sound files and spectrogram images were made of items of interest noted in the logs.

**INTMINS-November/98 Operations Summary**

(NOTE: All times are UT on the date indicated.)

European Passes

| Pass | ISTOCHNIK Start Time | Path during ISTOCHNIK Firing | Number of Observers Recording Data |
|---|---|---|---|
| E20-1 | 1532 | Croatia | |
| E20-2 | 1709 | Russia, south of Moscow | |
| E20-3 | 1838 | England | |
| E20-4 | 2013 | England | |
| E21-3 | 1548 | Northern Italy | 1 |
| E21-4 | 1728 | Croatia | |
| E21-5 | 1901 | Russia, south of Moscow | |
| E27-1 | 1254 | Central Italy | 1 |
| E27-2 | 1433 | Russia, south of Moscow | |
| E28-1 | 1312 | Northern Italy | 1 |
| E28-2 | 1451 | Russia, south of Moscow | |
| E28-3 | 1624 | Croatia | |

North American Passes

| Pass | ISTOCHNIK Start Time | Path during ISTOCHNIK Firing | Number of Observers Recording Data |
|---|---|---|---|
| 20-5 | 2301 | So. CA | |
| 21-1 | 0522 | WA | 1 |
| 21-2 | 0659 | No CA, So CA | 2 |
| 21-6 | 2319 | No CA, So CA | 1 |
| 22-1 | 0056 | WA | 1 |
| 27-3 | 2025 | So. CA, | |
| 28-4 | 2043 | No CA | 2 |
| 28-5 | 2219 | WA | 1 |

Summary of European Passes Recorded

| Team/Pass | E20-1 | E20-2 | E20-3 | E20-4 | E21-3 | E21-4 | E21-5 | E27-1 | E27-2 | E28-1 | E28-2 | E28-3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| E5 | | | | | x | | | x | | x | | |

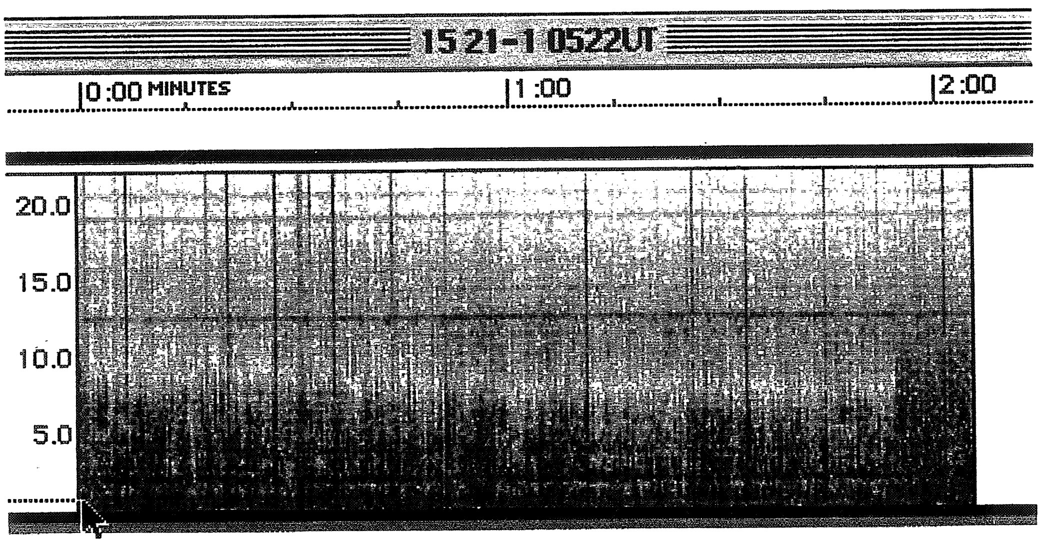
Summary of North American Passes Recorded

| Pass | 11/20 | 11/21 | | | 11/22 | 11/27 | 11/28 | |
|---|---|---|---|---|---|---|---|---|
| | 5 | 1 | 2 | 6 | 1 | 3 | 4 | 5 |
| Team | | | | | | | | |
| 7 | | | x | x | | | x | |
| 15 | | x | x | | | | x | x |
| 30 | | | | | x | | | |

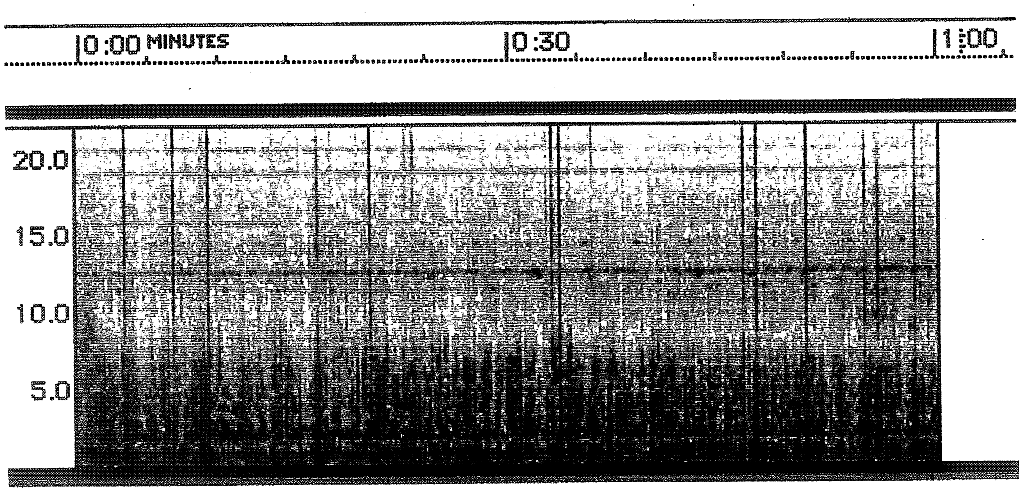
## INTMINS Data

The following spectrograms are taken from data tapes submitted by INSPIRE observers. The first view shown will be that of the entire two-minute interval analyzed. At the top of the image is the sound filename, which consists of the Team Number, operation number, and the start time of the operation. Subsequent views will be of portions of the first. Use the time scale at the top to determine the length of the view. Unless otherwise noted, the start time of the cropped view is the same as the start time of the operation.

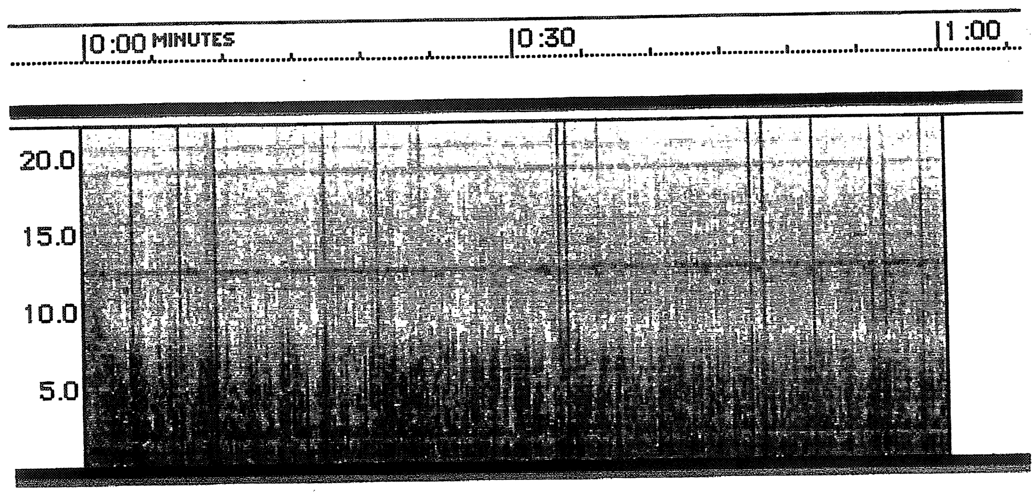
## 21-1




Team 15 Robert Bennett, Las Cruces, NM. This is a sensitive recording showing dense sferics and tweeks. These are typical late night conditions. The horizontal line at about 13.5 kHz is a manmade signal. The horizontal dashes above and below that line are from the Russian Alpha navigation system (similar to the now-defunct OMEGA system). LORAN is also audible, but the spectrogram signature does not show up on this scale.

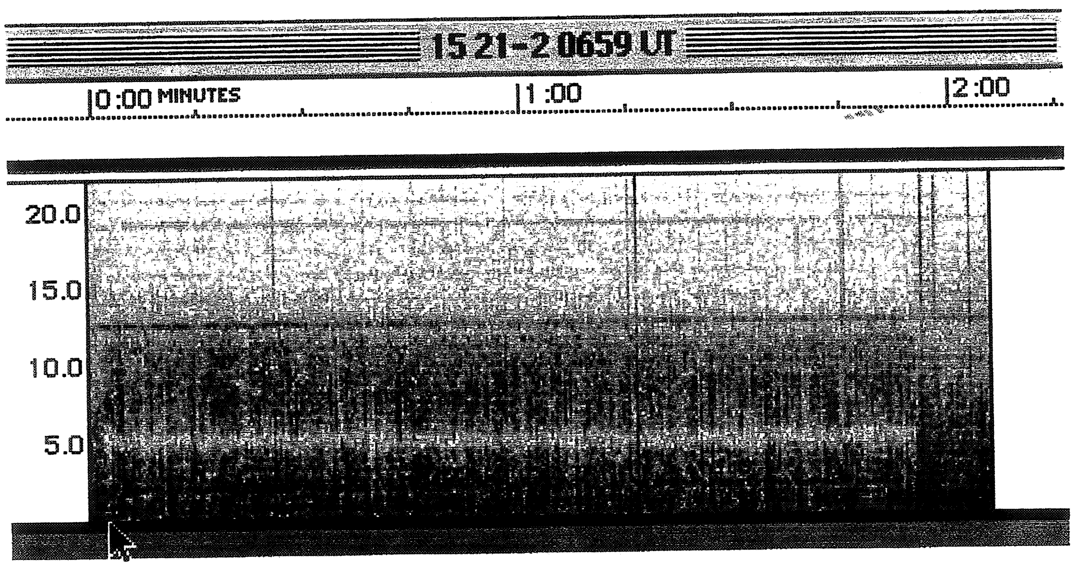



The first minute from above. Alpha dashes are easier to see.

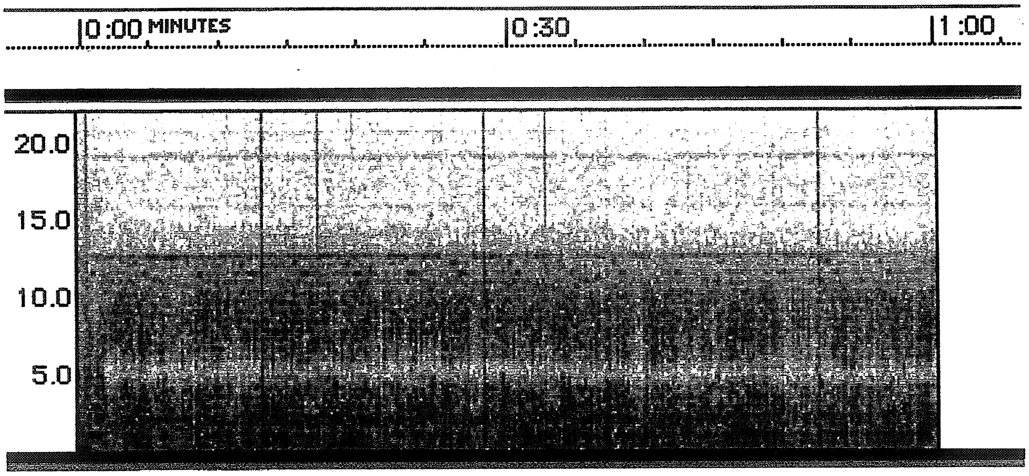


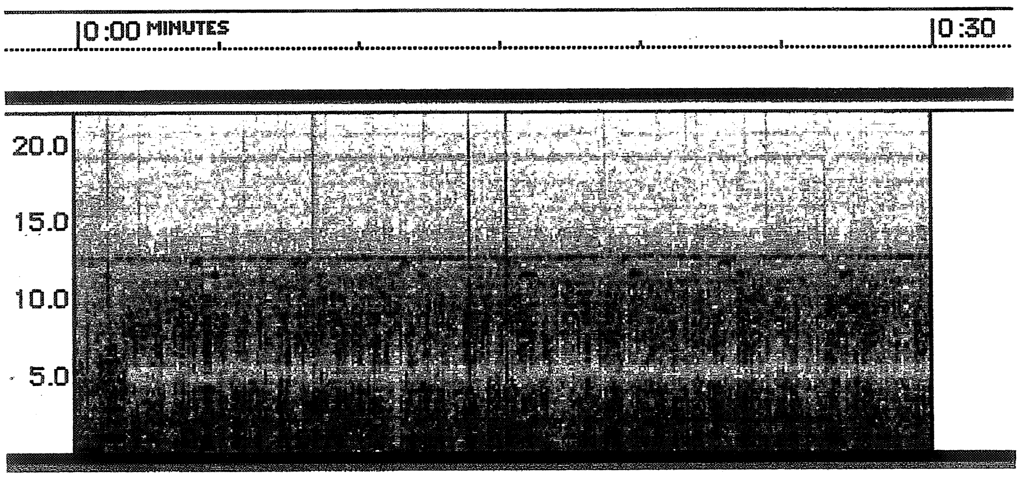

The first 30 seconds. The smudge-like band at about 2 kHz consists of the bottom "hooks" of the tweeks.

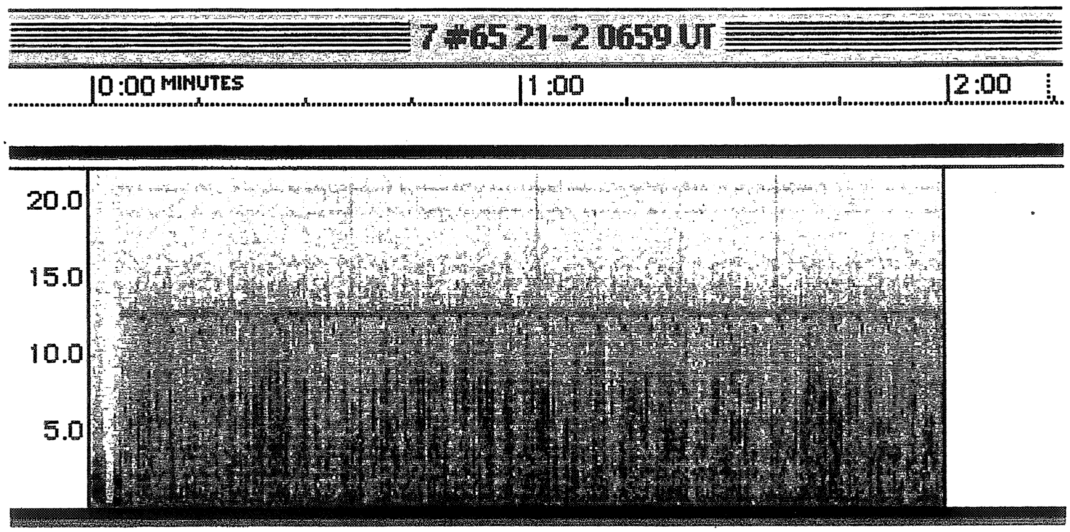
## 21-2



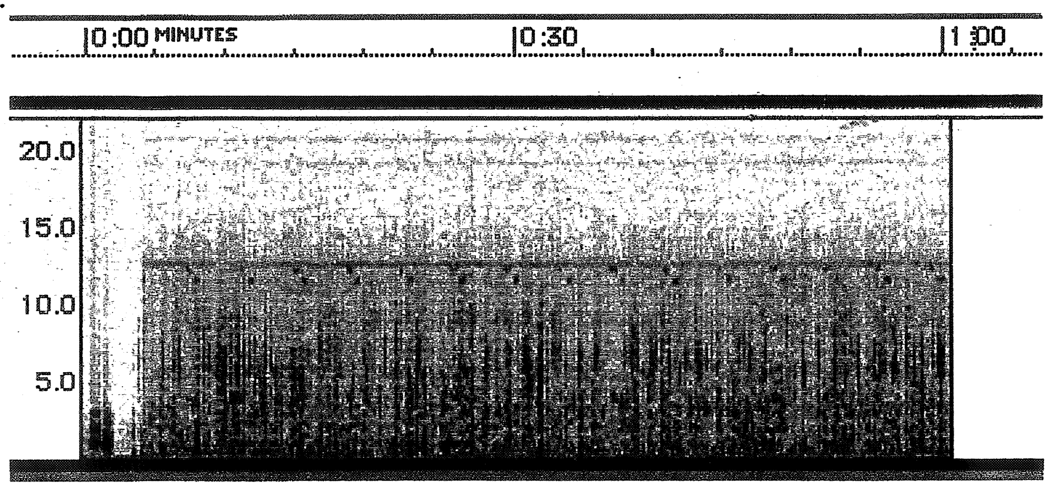

Team 15 Robert Bennett, Las Cruces, NM. Similar conditions remain about 1.5 hours after Operation 21-1. The arrow points to the 0659 UT WWV tone.


0:00 MINUTES
0:30
1:00
20.0
15.0
10.0
5.0

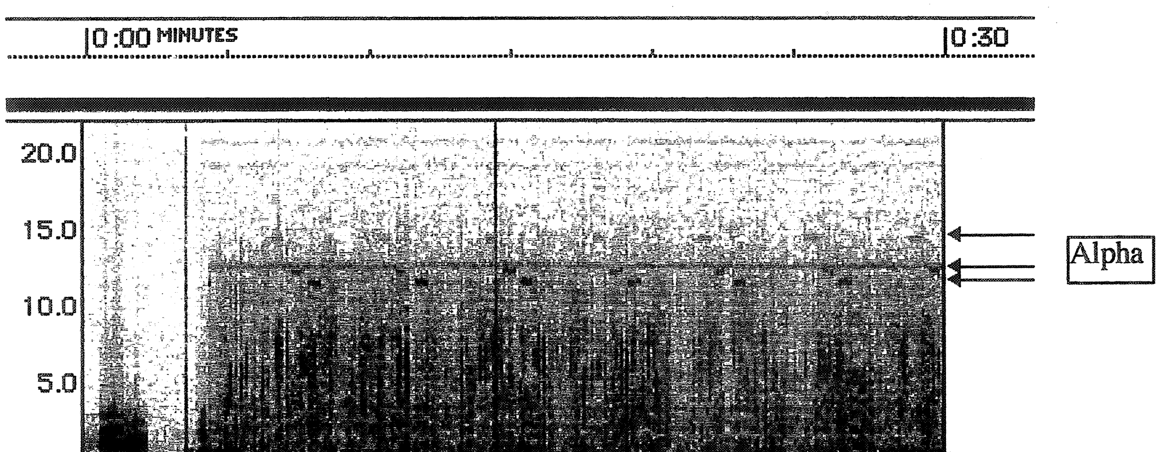

0:00 MINUTES
0:30
20.0
15.0
10.0
5.0




Team 7. Dean Knight, Sonoma Valley High School, Sonoma, CA. Dean and his students set up 3 RS4 receivers with different antennas and recorders. This is receiver #65 which uses a 91 foot longwire antenna oriented east-west. Note the similarities to Bob Bennett's results from New Mexico.

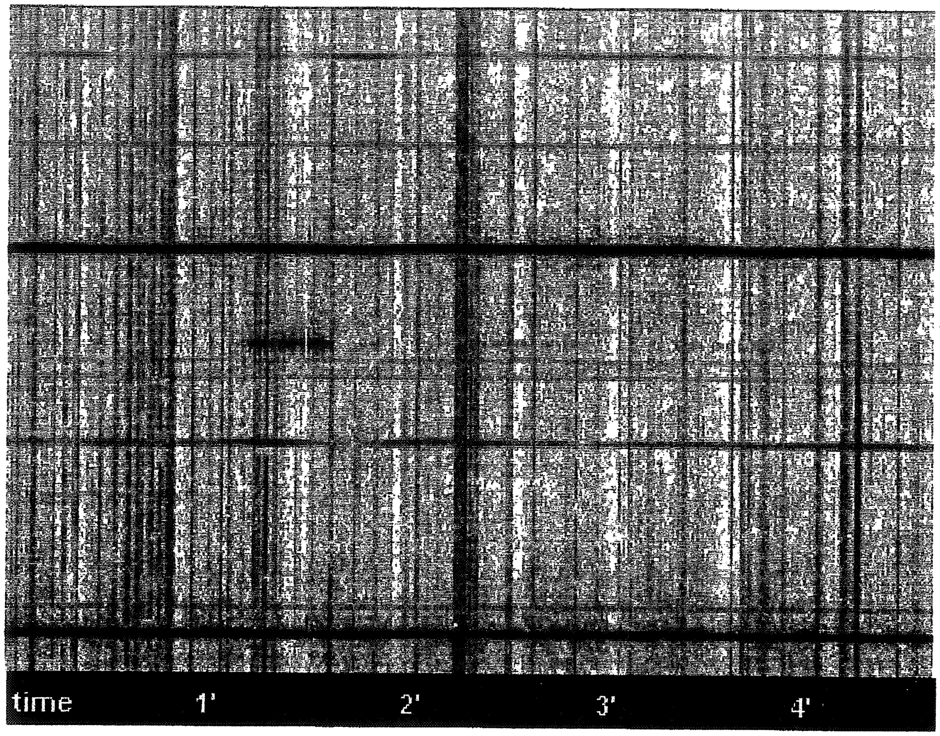



First minute.

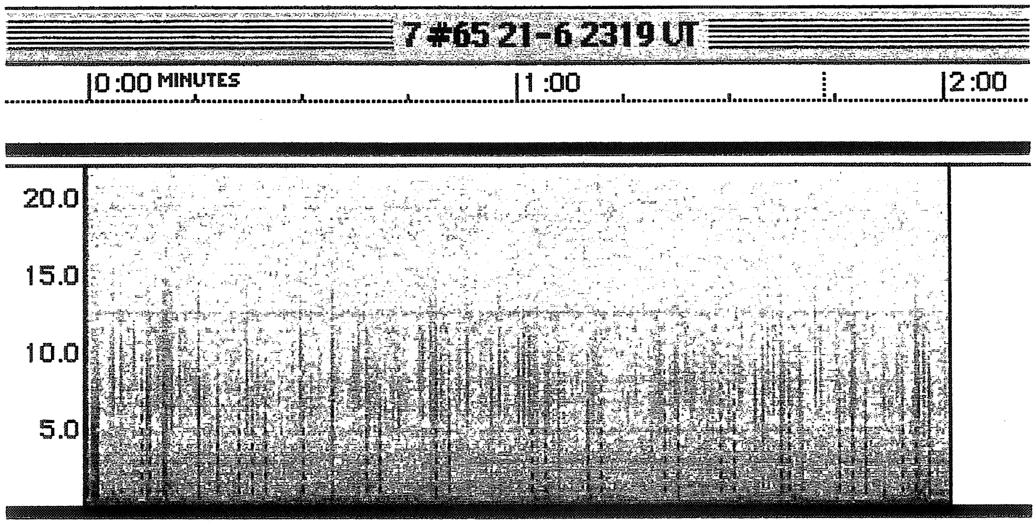



First 30 seconds. Alpha dashes are prominent. Alpha tones were audible on the tape.

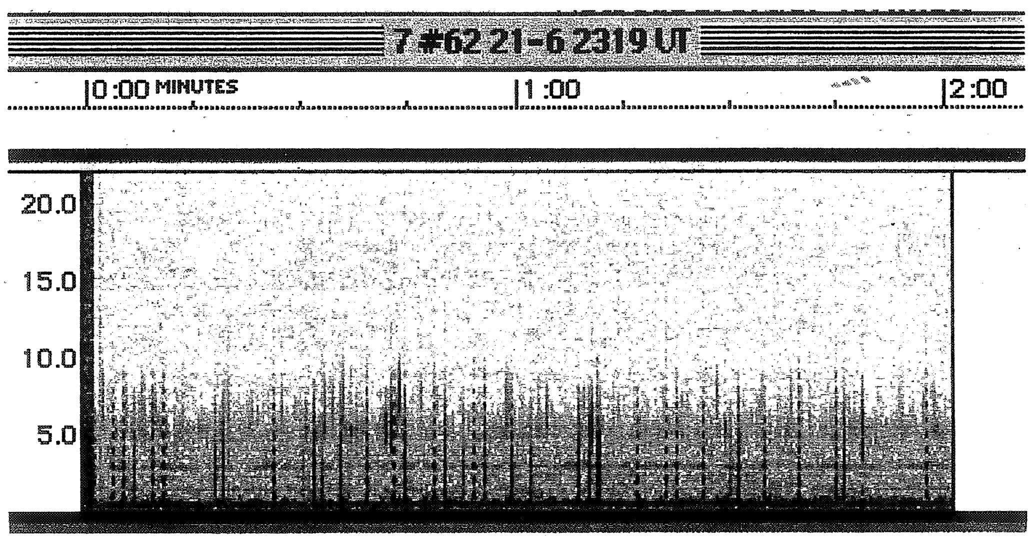
## E21-3



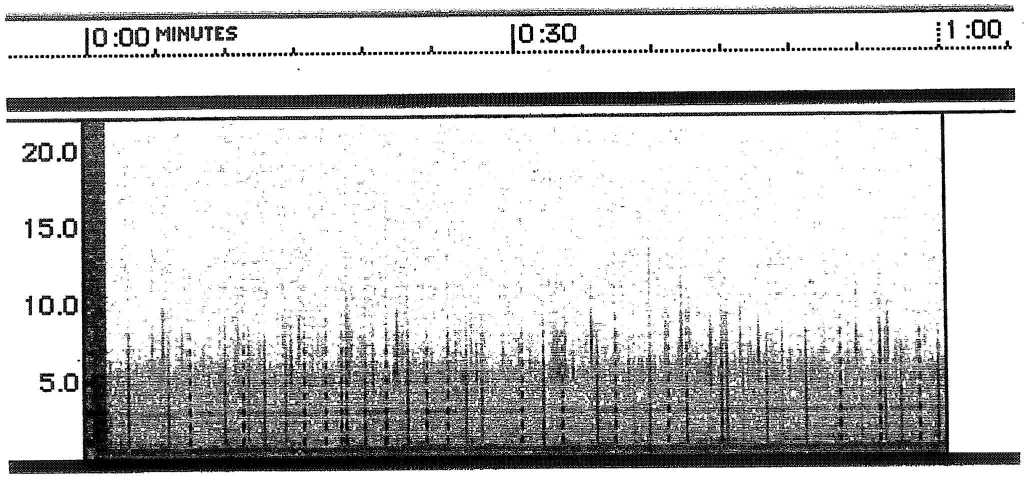

Team E5. Renato Romero, Cumiana, ITALY. Renato analyzes his own data. This is a view that includes the E21-3 operation time and shows a frequency range of 940- to 1122 Hz. ISTOCHNIK signals, if present, would show up as intermittent dashes 10 seconds on, 10 seconds off at 1000 Hz. The horizontal lines are harmonics of the 50 Hz powerline signals. Renato's analysis: "Static noise high; signals at 1025 Hz from power line in vertical field. Periodical noise in horizontal field. Nothing around 1000 Hz. "



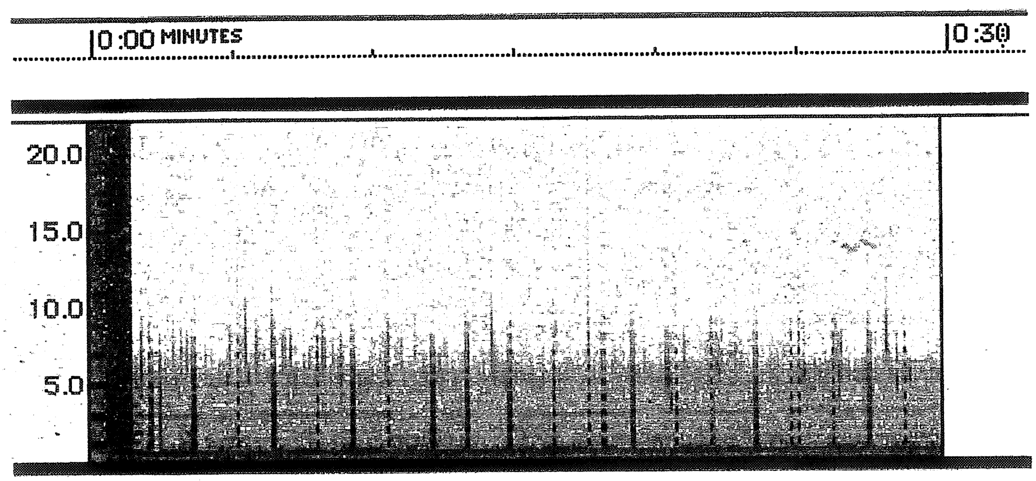

Team 7. Dean Knight, Sonoma Valley High School, Sonoma, CA. Sferics, but no tweeks. LORAN is present as is Alpha.




Team 7. This is receiver #62, which employs a 145 foot longwire antenna oriented east-west.

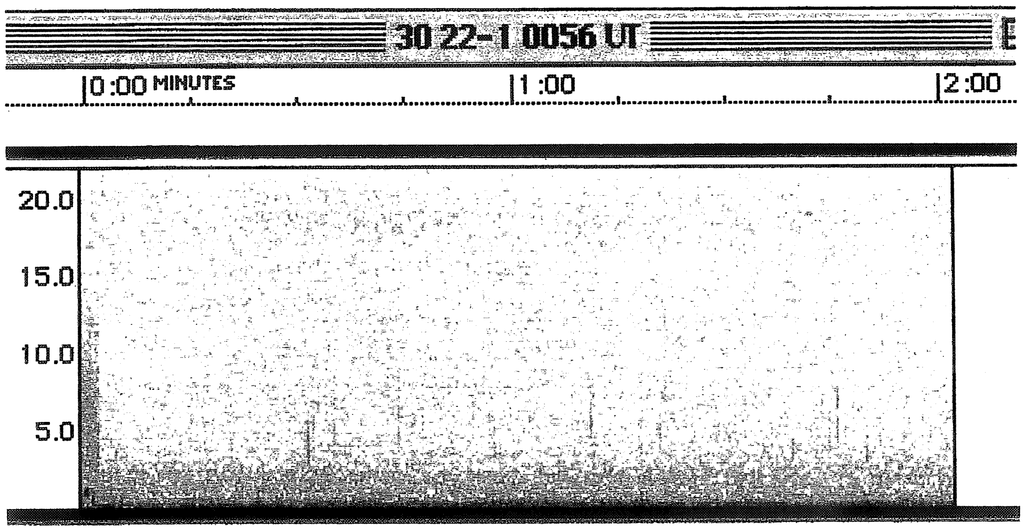



First minute from above. The vertical dashes are LORAN signals, which sound like rapid clicks.

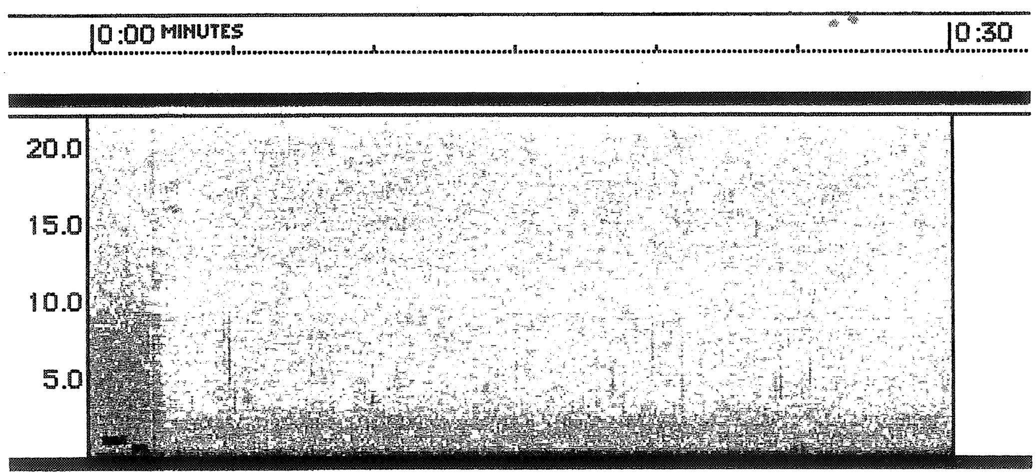



First 30 seconds. LORAN is prominent.

22-1

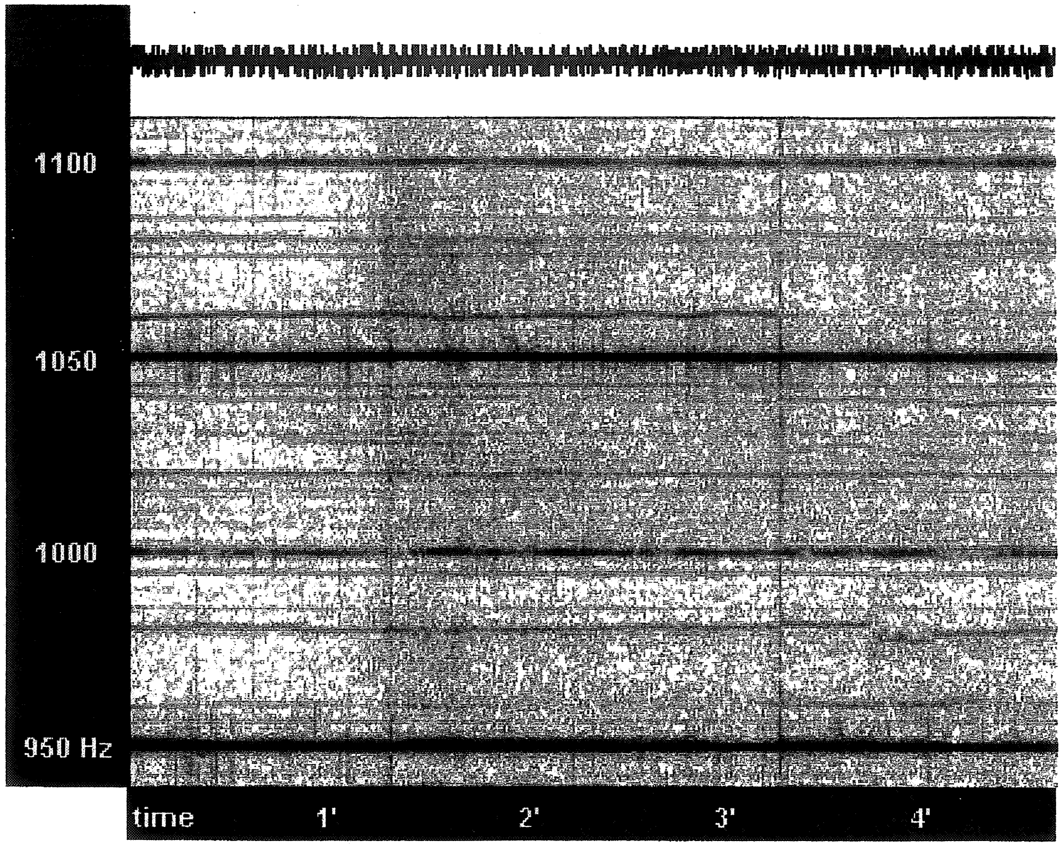



Team 30. Linden Lundback and Brian Cowan, Watrous, Saskatchewan, CANADA. This shows extremely quiet conditions. Linden and Brian are experienced observers who are very successful whistler hunters. Conditions this quiet might make one suspicious that the equipment is not operating properly. Sometimes it is this quiet, however.



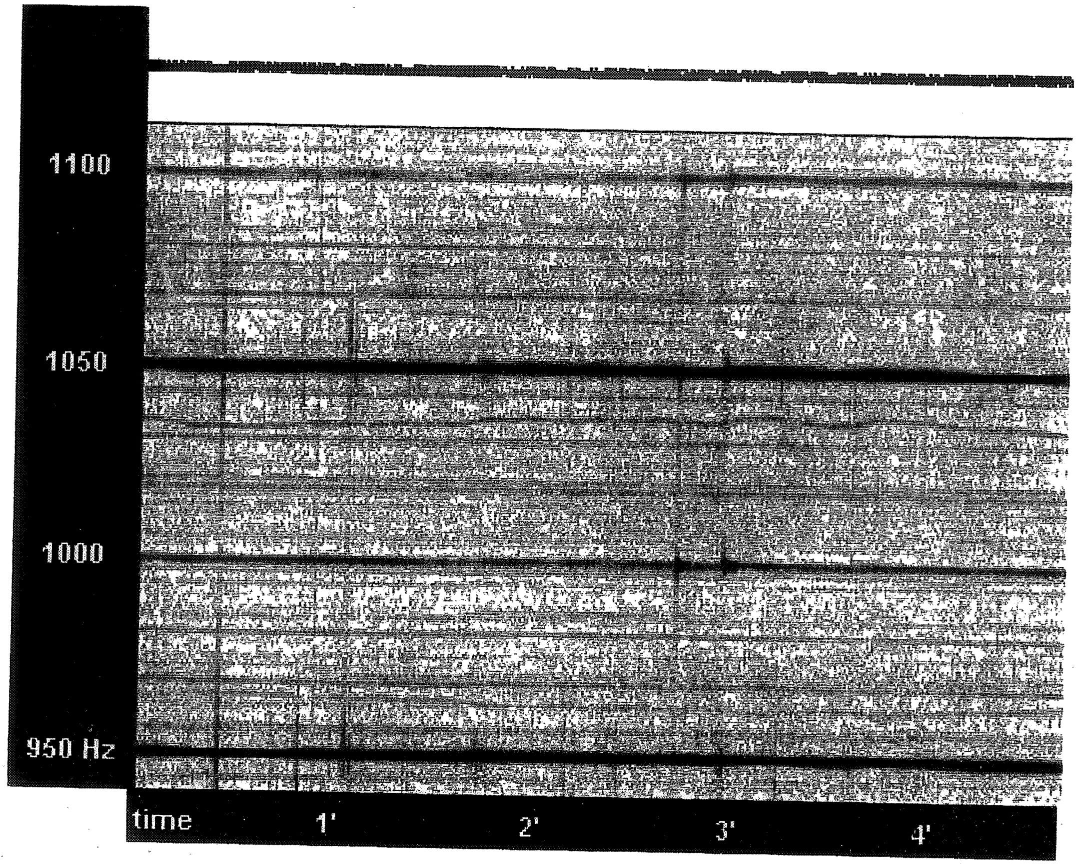

First 30 seconds. The dash at the beginning is the 1 kHz WWV tone.

## E27-1



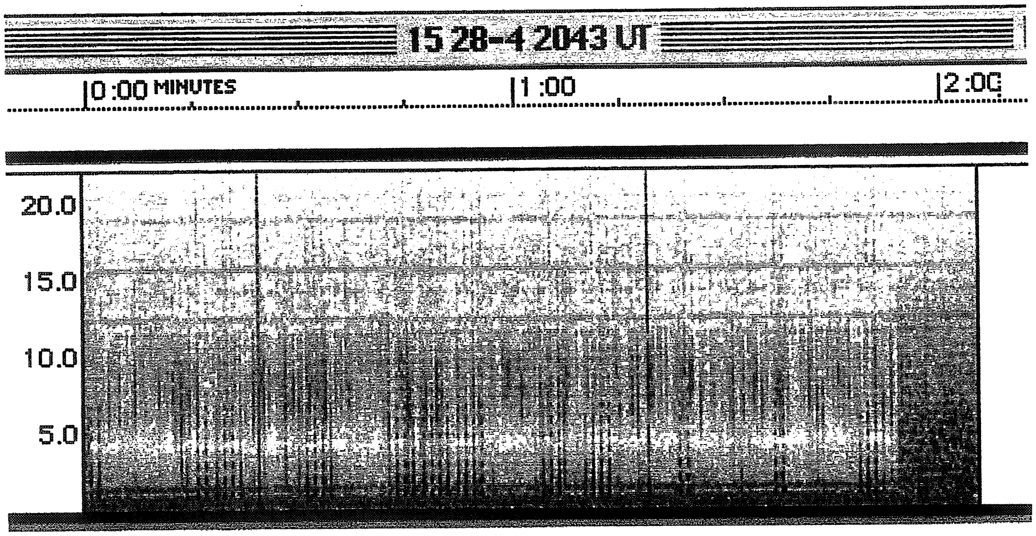

Team E5. Renato Romero, Cumiana, ITALY. "Static noise low, some interference from power line. Nothing around 1000 Hz."

**E28-1**

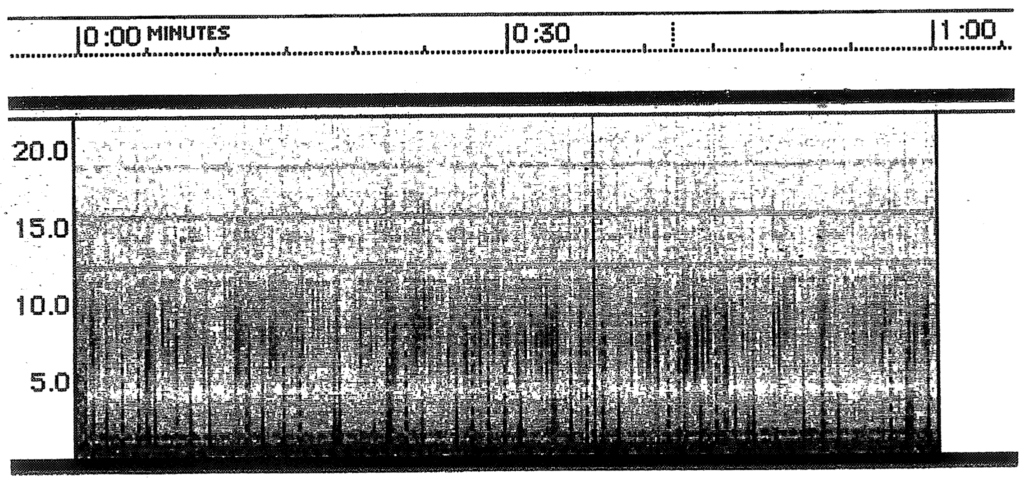


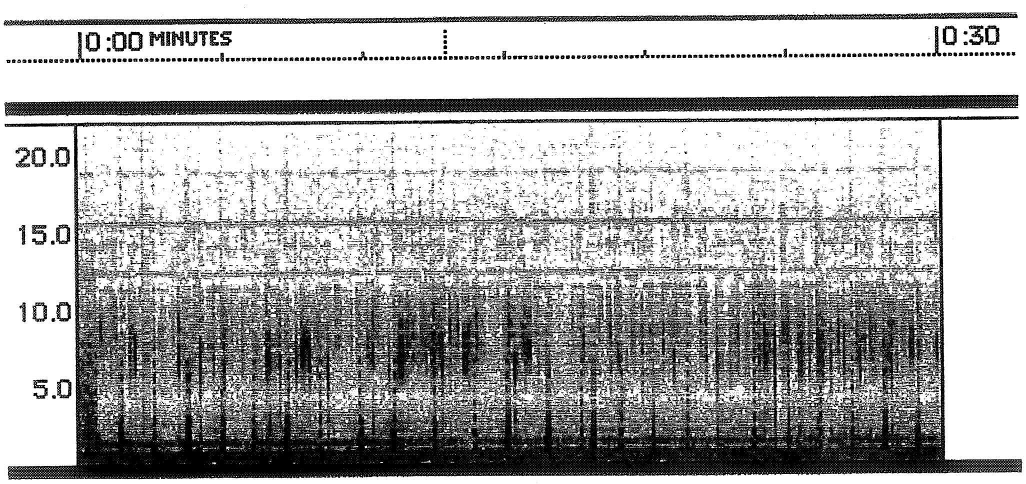

Team E5. Renato Romero, Cumiana, ITALY. "Static noise low, some interference from power line. Many weak tones in horizontal field. Nothing around 1000 Hz. "

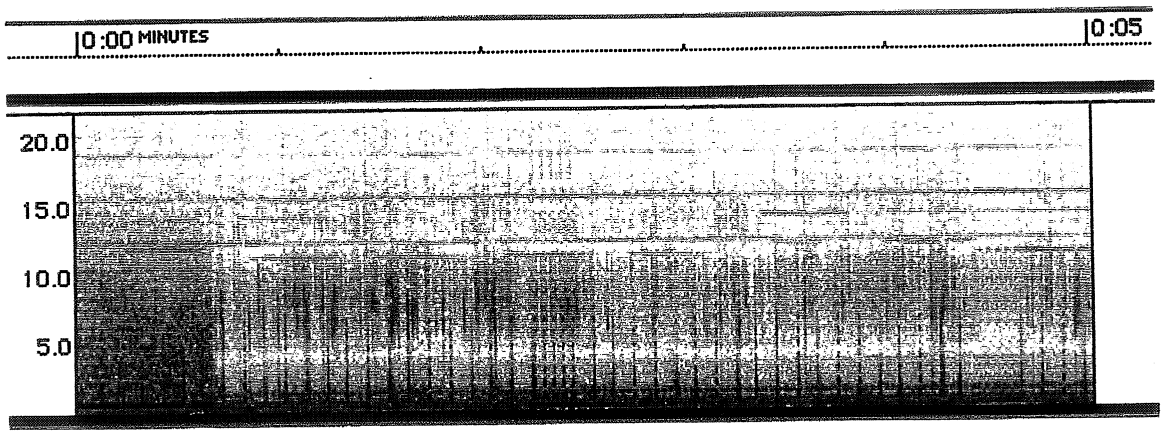
28-4



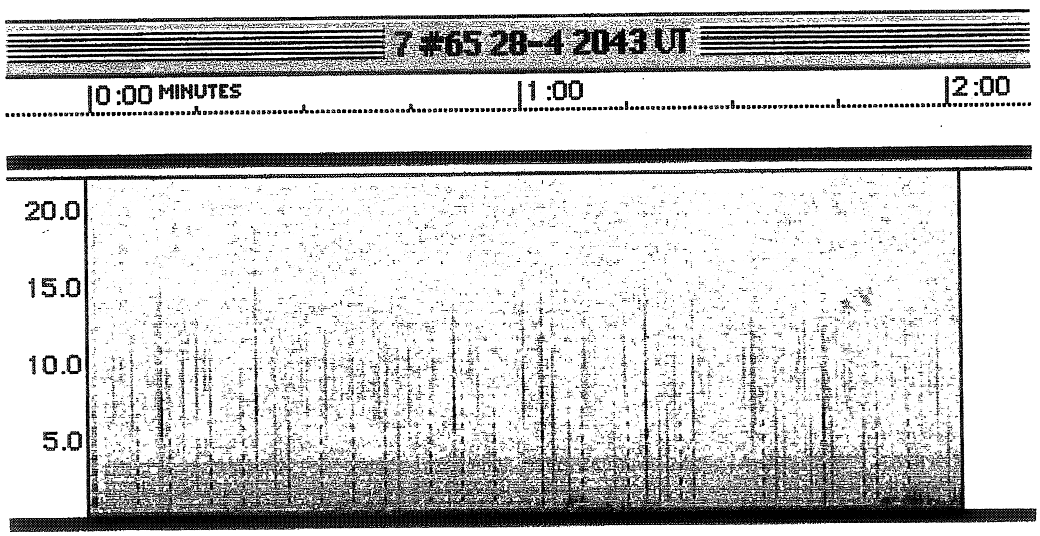

Team 15 Robert Bennett, Las Cruces, NM. Dense sferics, LORAN and Alpha.



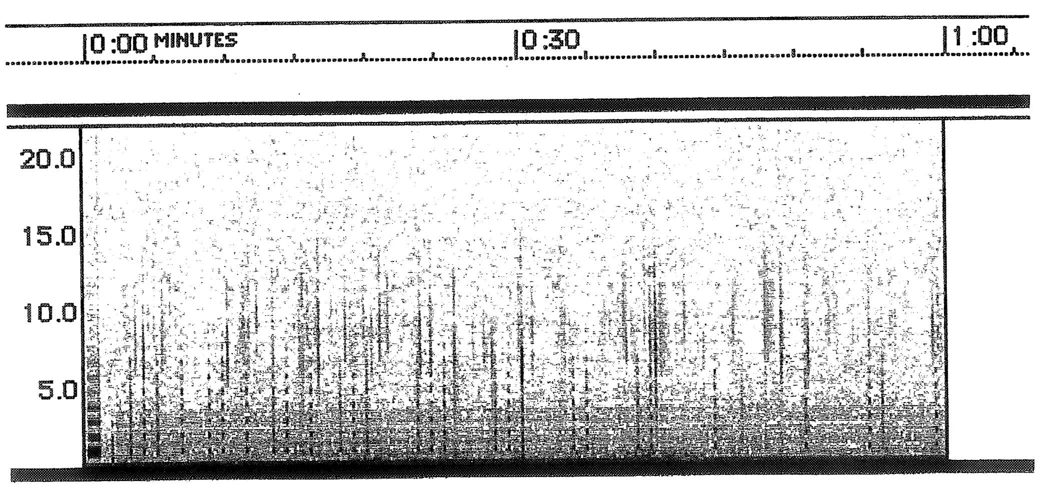





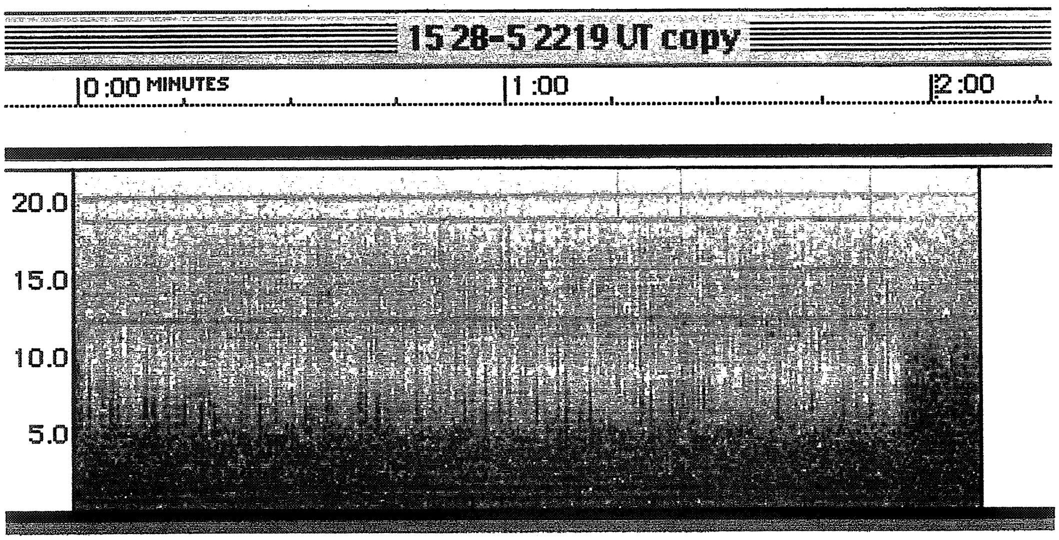

Close-up of 5 seconds showing Alpha dashes between 12 and 20 kHz.



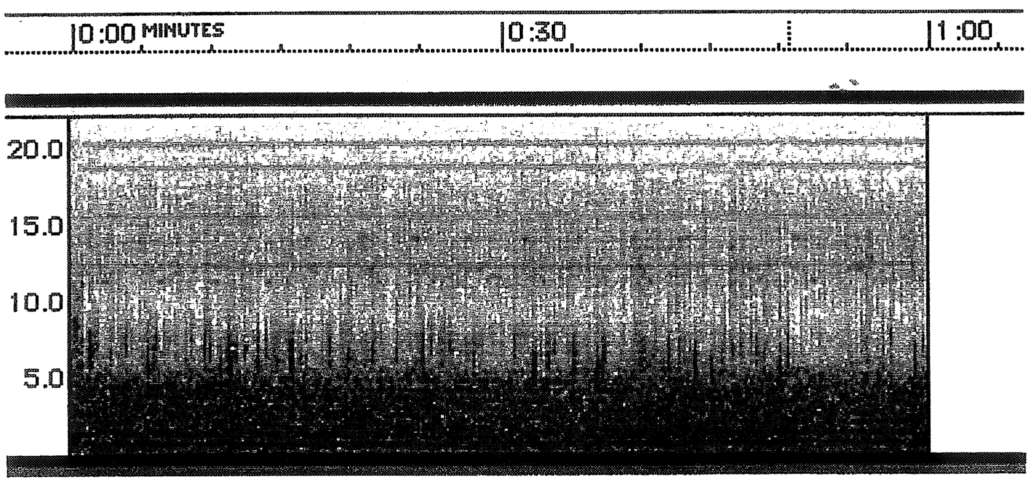

Team 7 Dean Knight, Sonoma Valley High School, Sonoma, CA. LORAN is strong, indicating that the receiver is working well. Very quiet conditions in contrast to those in New Mexico. Notice there are no Alpha signals which indicates poor propagation of this frequency range at this time.

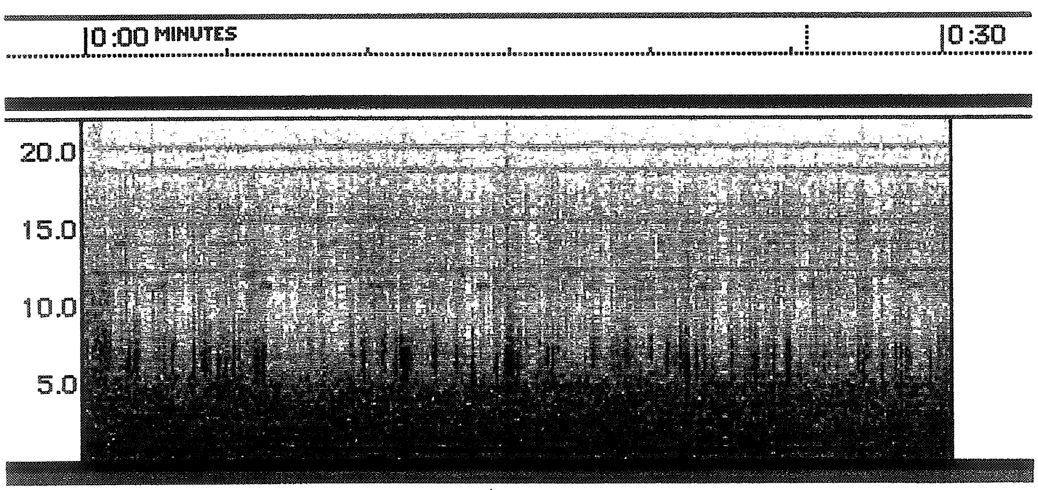


## 28-5




Team 15 Robert Bennett, Las Cruces, NM. About 1.5 hours after 28-4, sferics are even more dense.



# Report on Coordinated Observations 11/99

By Bill Pine
Ontario, California

The purpose of the Coordinated Observation Program is to provide an opportunity for INSPIRE participants to gather data at convenient times for purposes of comparing the resulting signals and attempting to interpret them. Since there is no manmade source of VLF that is being studied here, the signals of interest are those of natural origin. As in most natural radio listening, we would like to hear something "interesting". Most of that time that would be whistlers, but other sounds such as tweeks, chorus, triggered emissions and even hiss are also interesting. Observing whistlers, however, remains the prize for faithful listening. The problem with whistlers is that they are not the most common natural radio signal. Since coordinated listening schedules are determined arbitrarily and in advance of the listening sessions, it is only a matter of luck if whistlers are available to be detected. The experience of the author is that whistlers are heard about once every four or five morning sessions. When they are present, you will probably hear a lot of them until the rotation of the earth carries the ducting magnetic field lines into an unfavorable alignment. Conditions during November 1999 varied. There were some interesting signals observed including chorus, whistlers and an amazing echo train caught by an observer in Colorado. The following report includes sample spectrograms from contributing observers.

This table summarizes the sessions monitored by observers.

| Date | 11/20 | | | | 11/21 | | | |
|---|---|---|---|---|---|---|---|---|
| Time | | 1300 | 1400 | 1500 | 1200 | 1300 | 1400 | 1500 |
| Team | | | | | | | | |
| 11 | | | C | | | | | |
| 25 | | C | C | | | C | C | |
| 30 | | | C | C | | | C 11/27 | C 11/27 |
| 32 | | | | | | M | M | |

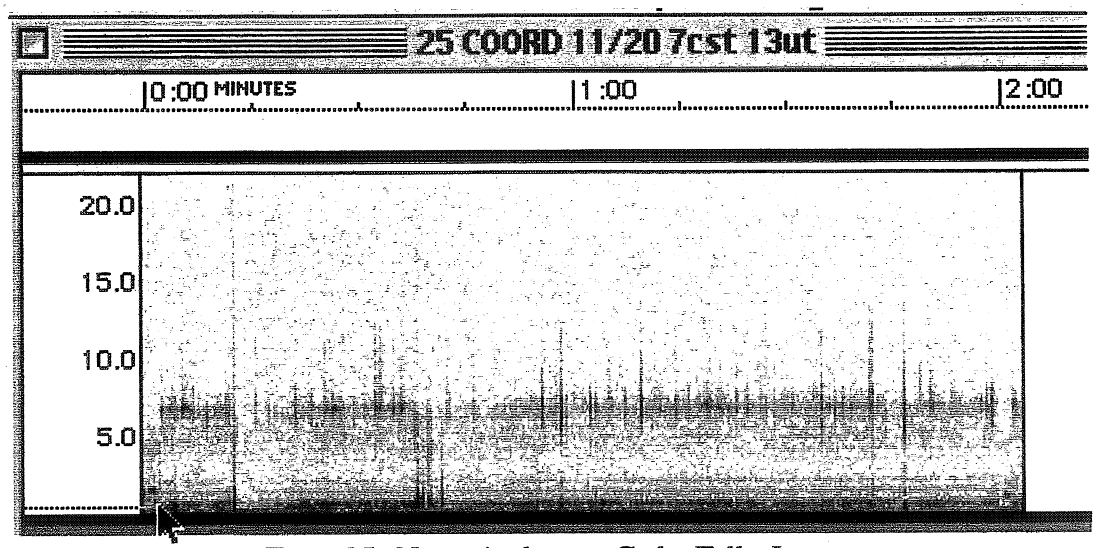
The times indicated are UT times.
The letter in the box indicates the time zone of the observer:
E = EST = UT-4, C=CST = UT-5,
M = MST = UT-6 and P = PST = UT-7

| | | | |
|---|---|---|---|
| Observers: | Team 11 | Mark Mueller, Brown Deer, WI<br>Brown Deer High School | (CST) |
| | Team 25 | Norm Anderson, Cedar Falls, Iowa | (CST) |
| | Team 30 | Linden Lundback, Watrous, Saskatchewan, CANADA | (CST) |
| | Team 32 | Shawn Korgan, Gilcrest, CO | (MST) |

For analysis purposes, a spectrogram was made of the first two minutes of each 12-minute hourly session. Additional spectrograms were made of any items of interest and of any segments requested by the observer. Time marks were placed on the tape every two minutes and a complete log was made of each session.

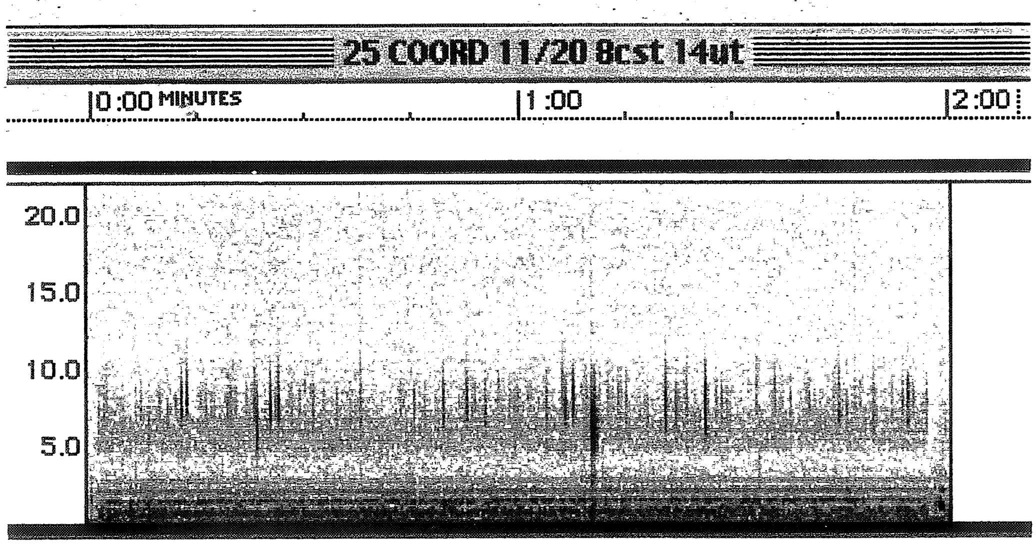
## 11/20/99 1300 UT

Norm Anderson started off at 0700 CST (0800 EST).

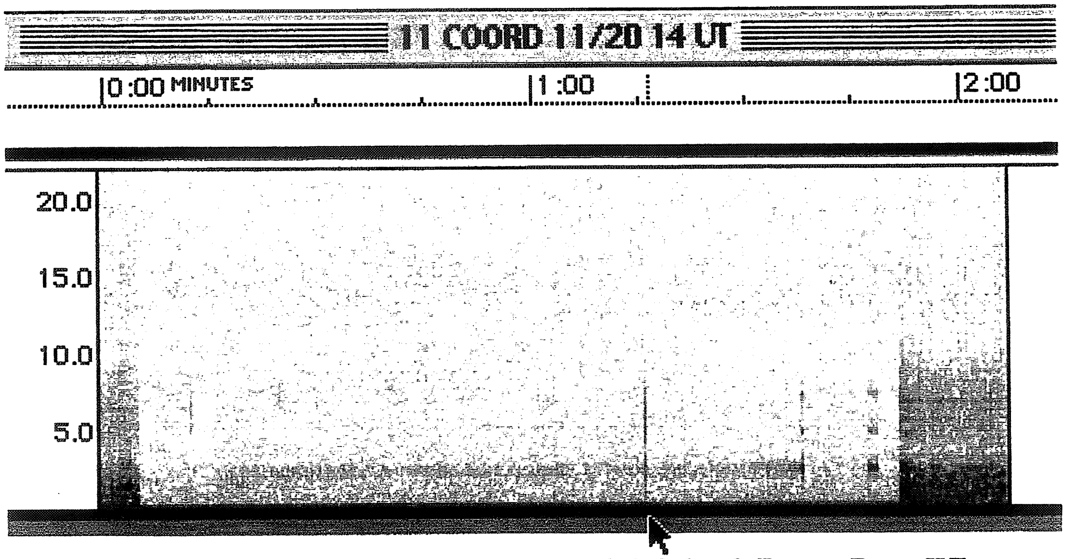



Team 25. Norm Anderson, Cedar Falls, Iowa
Arrow shows 1300 UT WWV tone. Very quiet conditions.

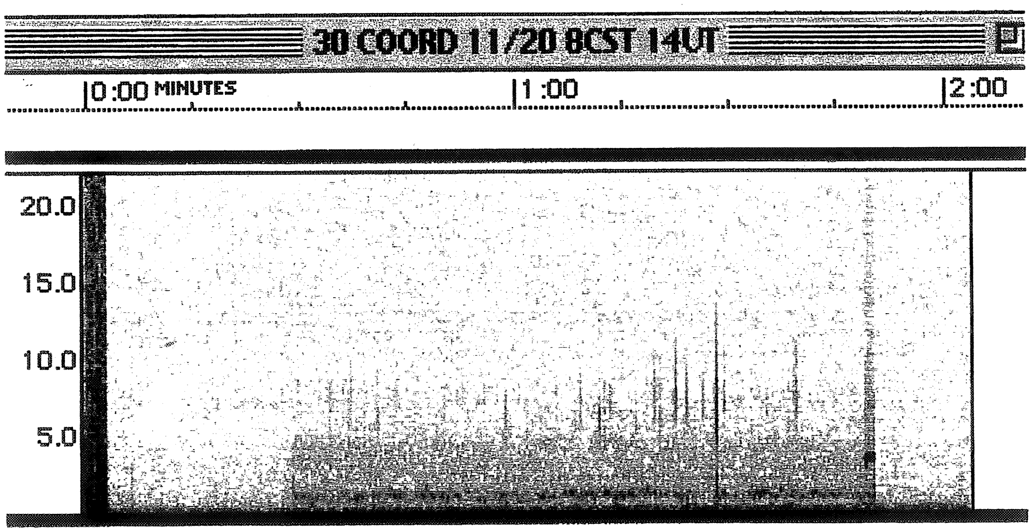
## 11/20/99 1400 UT



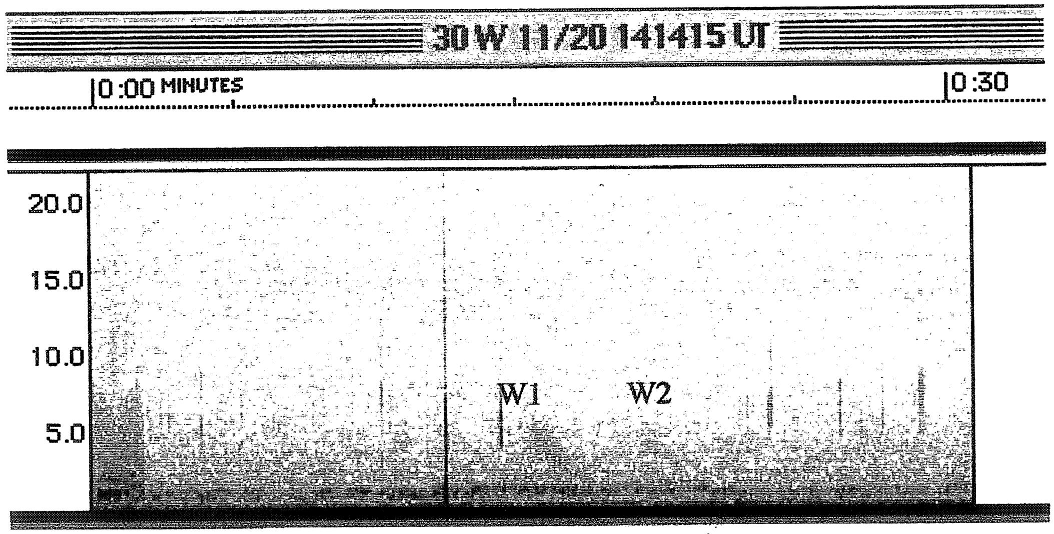

Team 25. Norm Anderson, Cedar Falls, Iowa



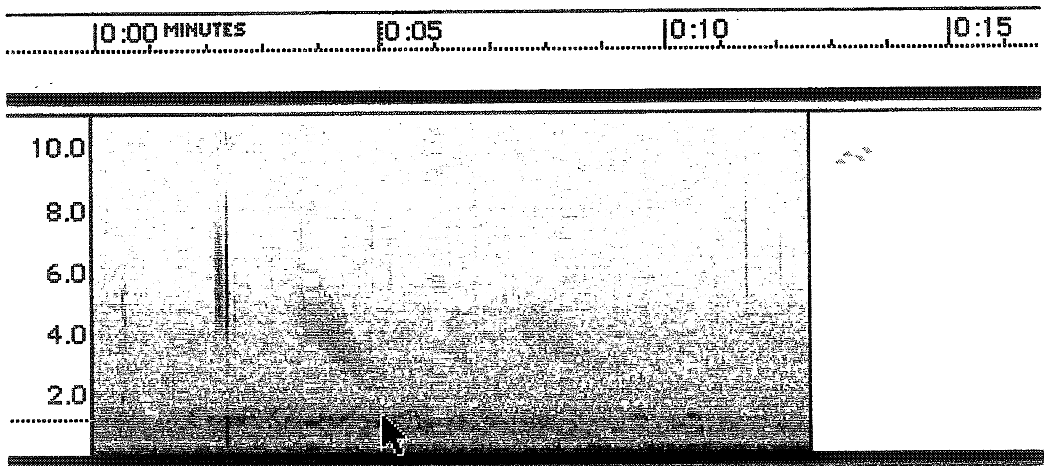

Team 11. Mark Mueller, Brown Deer High School, Brown Deer, WI.
The arrow points to a strong sferic in the middle of some real quiet conditions.



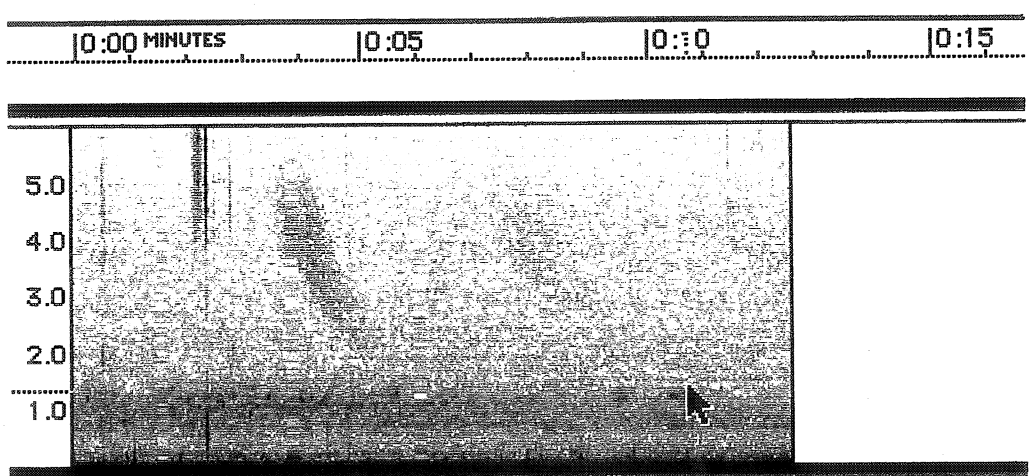

Team 30 Linden Lundback / Brian Cowan Watrous, Saskatchewan, CANADA
At the start of the day's observations, it took about 30 seconds to get the signal adjusted.
Generally quiet conditions with sferics, chorus and weak whistlers.
It is an advantage to observe from farther north. Chorus is almost never heard in Southern California and whistlers are also less common there.




From the "Whistler Extra" tape following the scheduled coordinated observations. W1 logged at 141415 UT; W2 (looks like an echo of W1) logged at 141418 UT.

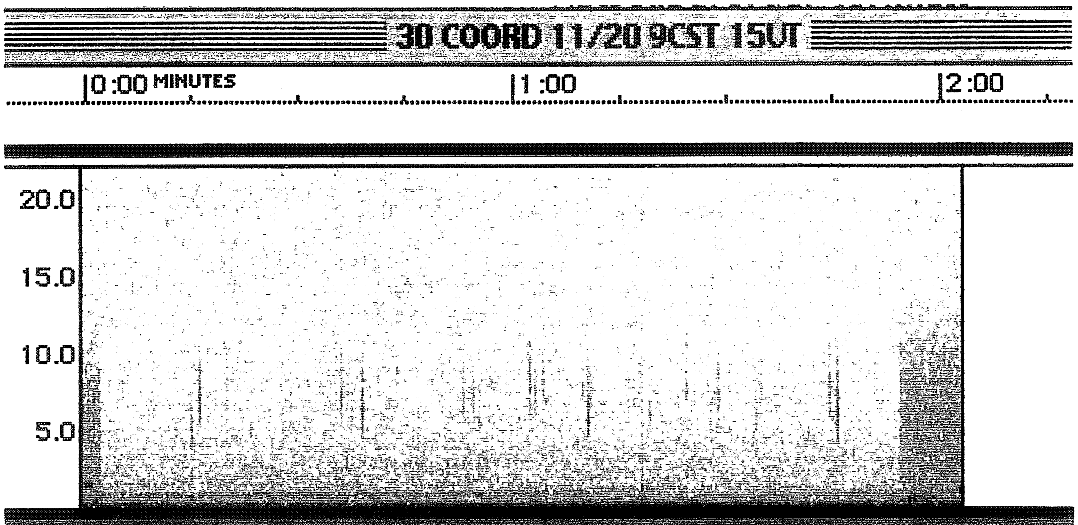



The arrow points to W1.
The local sferic that caused the whistler and echo can be seen at :02 seconds.

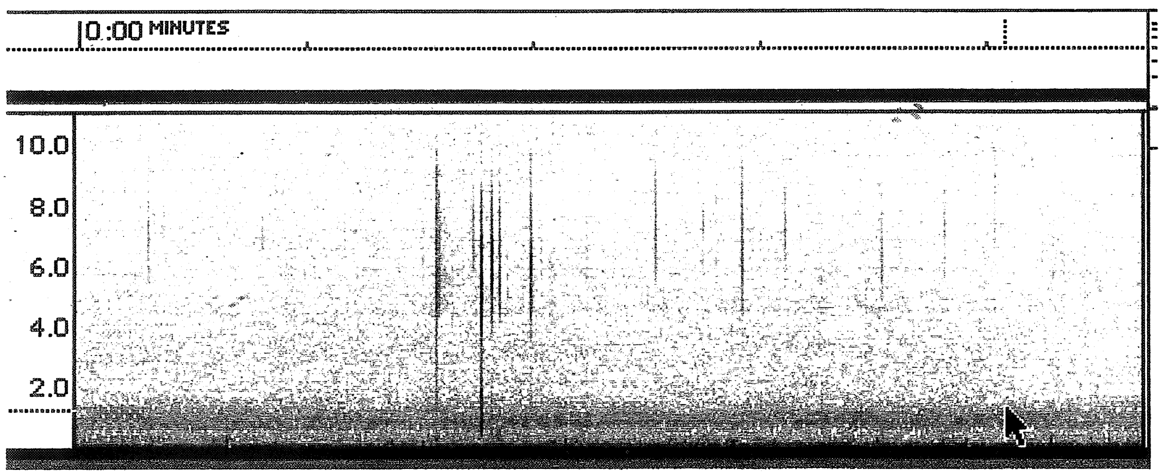



Same as above using a 0-6 kHz frequency range. Arrow points to W2.

**11/20/99 1500 UT**

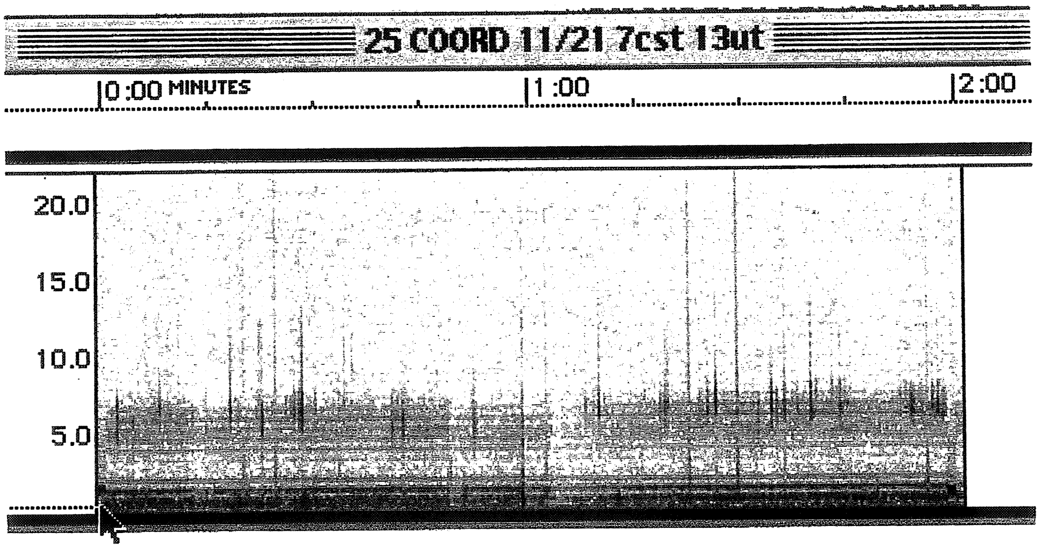



Team 30 Linden Lundback / Brian Cowan Watrous, Saskatchewan, CANADA. Quiet.

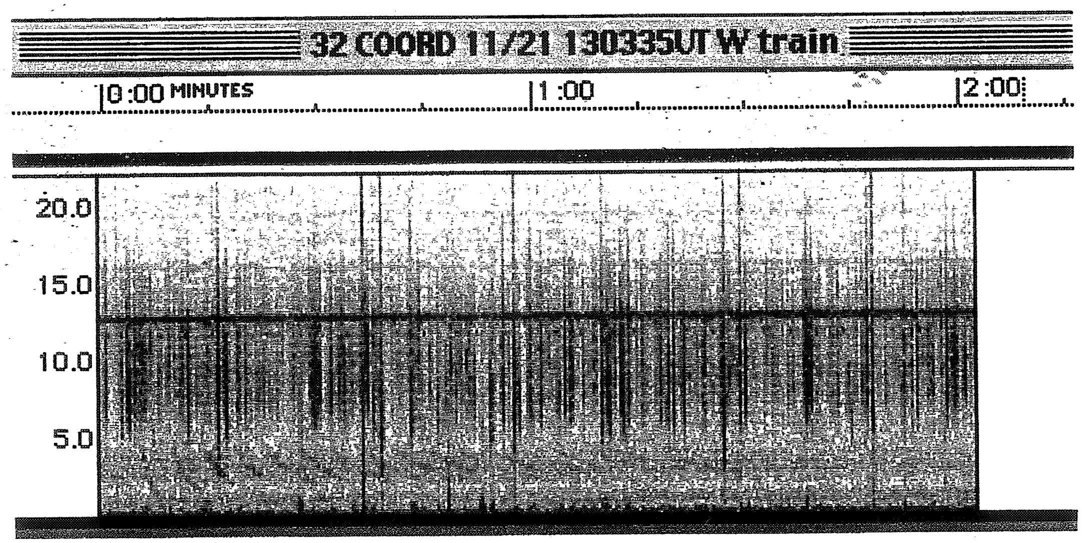



Arrow points to the bottom of a faint whistler recorded on another "Whistler Extra" tape. Whistler was logged at 15:22:58 UT.

## 11/21/99 1300 UT



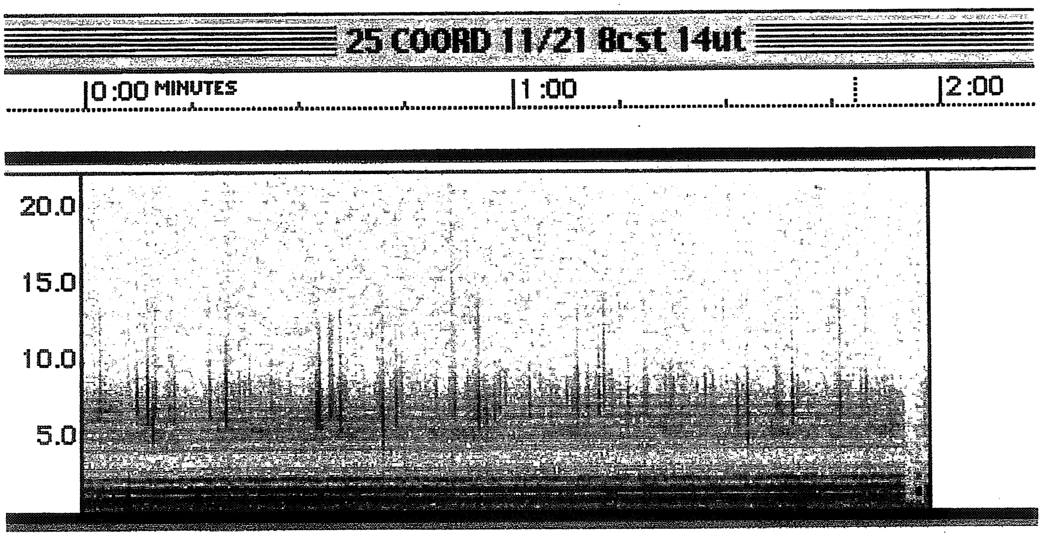

Team 25. Norm Anderson, Cedar Falls, Iowa
A bit more hum on this day, but still good reception of quiet conditions.



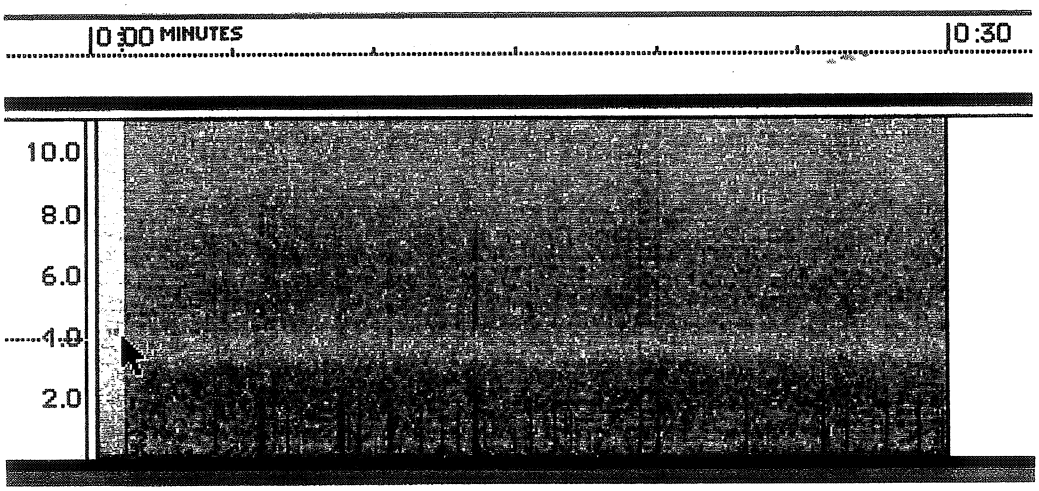

Team 32. Shawn Korgan, Gilcrest, CO
This is a "long whistler" logged at 13:03:35 UT. Shawn reports hearing the whistler for more than two minutes. It is actually one whistler with 26 echoes in the two minute period. Actually, the echoes don't stop there, but continue to fade.

Time marks were a problem on this tape. Shawn tried to put WWV continuously on one track with the signal on the other track, but WWV did not record for some reason. This is probably a good thing since the practice of putting WWV on one track is discouraged. The reason is that on a recorder with automatic gain control (AGC), strong signal on one track will reduce the sensitivity of both channels and may adversely affect the recording of the receiver signal. It is certainly a good thing nothing harmed the recording of this amazing echo train!

## 11/21/99 1400 UT

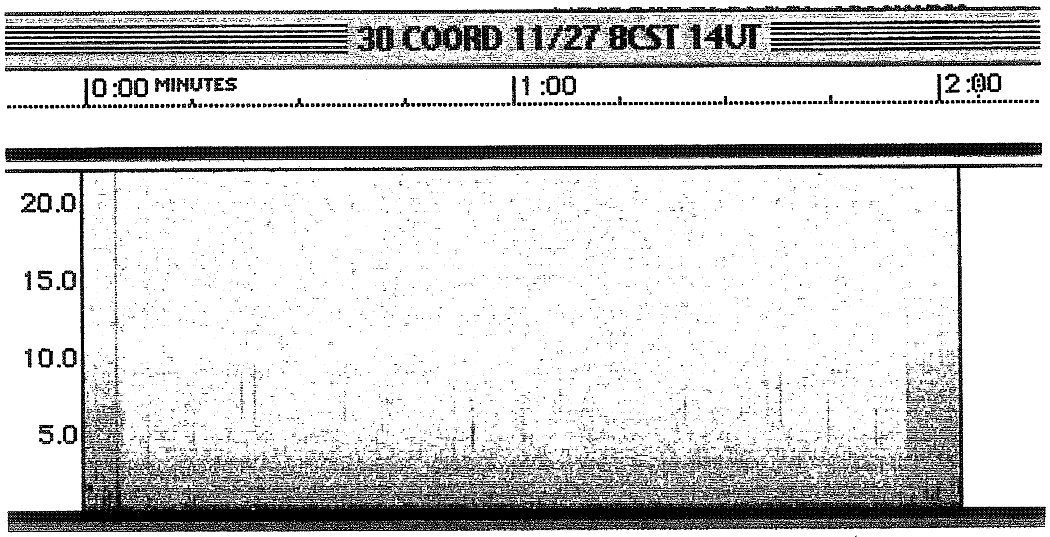



Team 25. Norm Anderson, Cedar Falls, Iowa
Similar to an hour earlier.



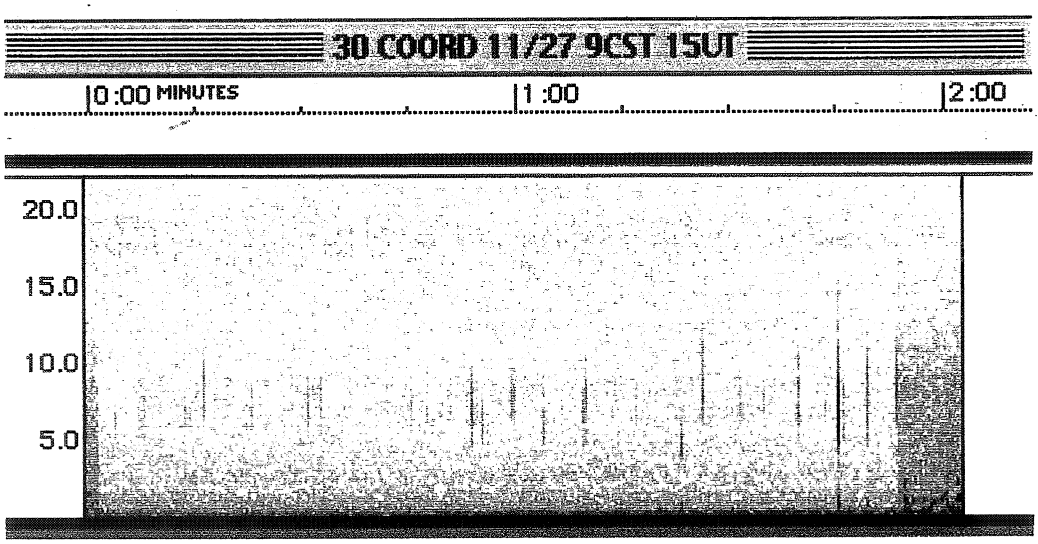

First 30 seconds. Arrow points to "beeps" at 7:00 AM EST.

## 11/27/99 1400 UT




Team 30 Linden Lundback / Brian Cowan Watrous, Saskatchewan, CANADA
Linden and Brian also recorded on the weekend following the Coordinated Observations.
Conditions were very quiet for both hours.

## 11/27/99 1500 UT




Team 30 Linden Lundback / Brian Cowan Watrous, Saskatchewan, CANADA

# Notes From the Field

## Communications from INTMINS Participants

Edited by Bill Pine
Chaffey High School
Ontario, CA

Notes and messages often accompany data submissions from INTMINS participants describing various aspects of their experiences as observers. As an ongoing feature, some of these communications will be summarized in *The INSPIRE Journal*. The following summaries are in the approximate order in which the data was received by INSPIRE. In addition, some communications will be included from INSPIRE participants who did not record and submit data.

### Team 32 Shawn Korgan Gilcrest, CO

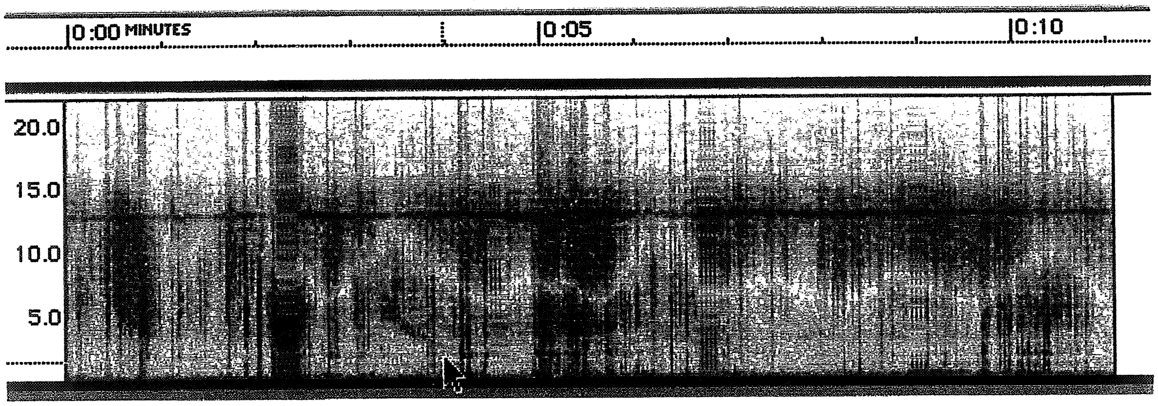
Shawn sent in a tape containing excerpts from several sessions recorded during June and July 1999.

> I found out recently that listening to VLF on top of a high mountain (12,000 feet or better) makes a huge difference in how one receives VLF signals. I have come to the conclusion that a person can hear five to ten times more on top of a tall mountain that at ground level near home. I hear sounds in the mountains that I have never heard on the ground before like strange chirps and weird whistlers that are not normally heard on the ground.
>
> One day when I was up recording on Trail Ridge Road (a mountaintop road in Colorado), I started hearing strange bouncy sounding signals that usually came in pairs of two to maybe seven or so. I could not for the life of me figure out what these strange sounds were. y friend noticed that we seem to only hear them when cars were going by. He was right. We could actually watch cars drive over certain spots in the road and hear corresponding bouncy signals. I concluded that it was shock waves from the pavement rebounding from the vehicle that was driving on that part of the road. Also, only the heavier vehicles seemed to really set off the sounds and I could only hear the sounds when the pavement was at a certain temperature. When the outside temperature reaches about 45-50 degrees F or so, then I start to hear these strange signals. If the temperature rises above that then I do not hear them. I describe them as bouncy sounding chirps (some rising in frequency and some falling in frequency). I can hear these sounds from vehicles approaching up to 1000 feet away. You may want to use the headphones to hear these sounds on the tape. [*Editor's note: The sounds were definitely on the tape, but very subtle. Unfortunately, I was unable to get them to appear on the spectrogram due to their faint nature.*]
>
> I found a perfect way to test my VLF receiver. I noticed that a rubber band is easily picked up by a VLF receiver. When my receiver is working properly, I can hear a large rubber band about 3 feet away with a three inch antenna on my receiver. If something is not working right, like when my FET is going bad, then I can only hear the rubber band sound about one foot or less away from

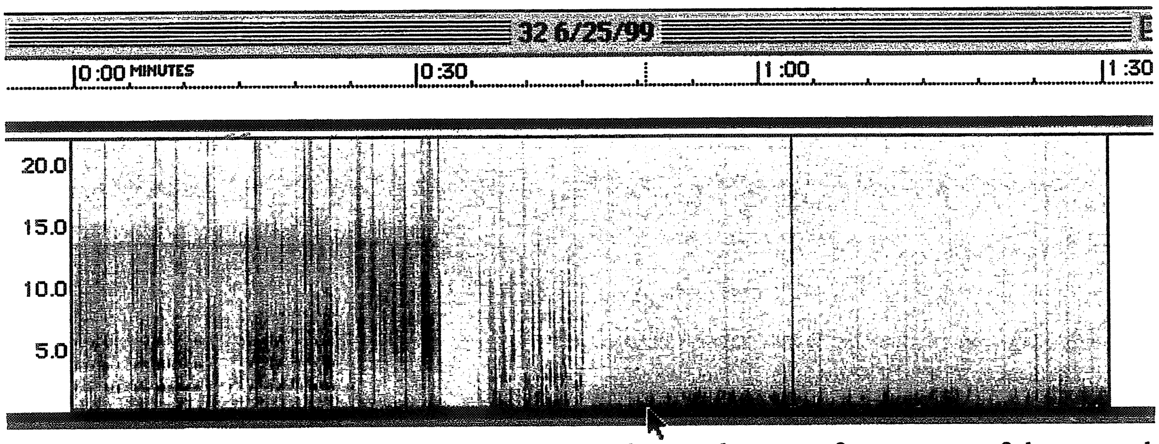
the VLF receiver. This may be a good way to test the sensitivity of different receivers to VLF signals and to determine which receiver is best.

One more note: I am corresponding with a gentleman at the NIST (WWV towers) in Fort Collins, CO, about the 13 kHz signal I am hearing on my VLF receiver. I want to make sure that the signal is coming from the WWV tower. I have no heard back from him for a week or so. Steve McGreevey questioned whether such a signal could be coming from the WWV towers. I just want to find out for sure where the signal is coming from and put the issue to rest.

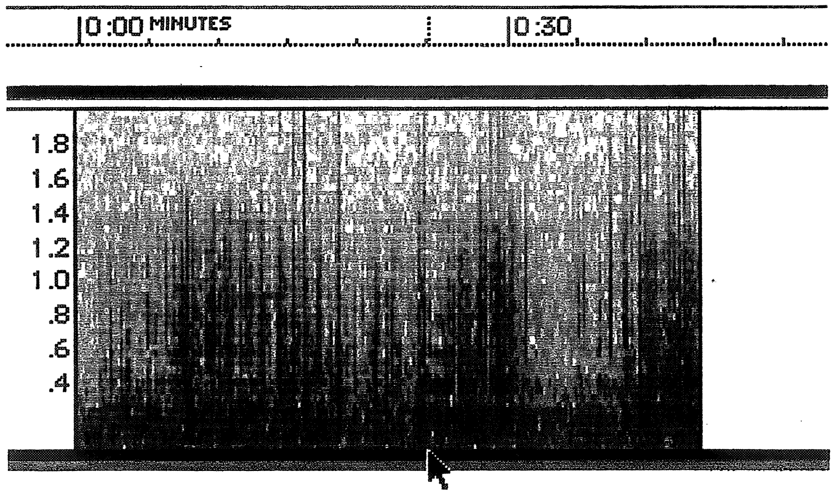
Here are some samples from Shawn's summer 1999 observations.



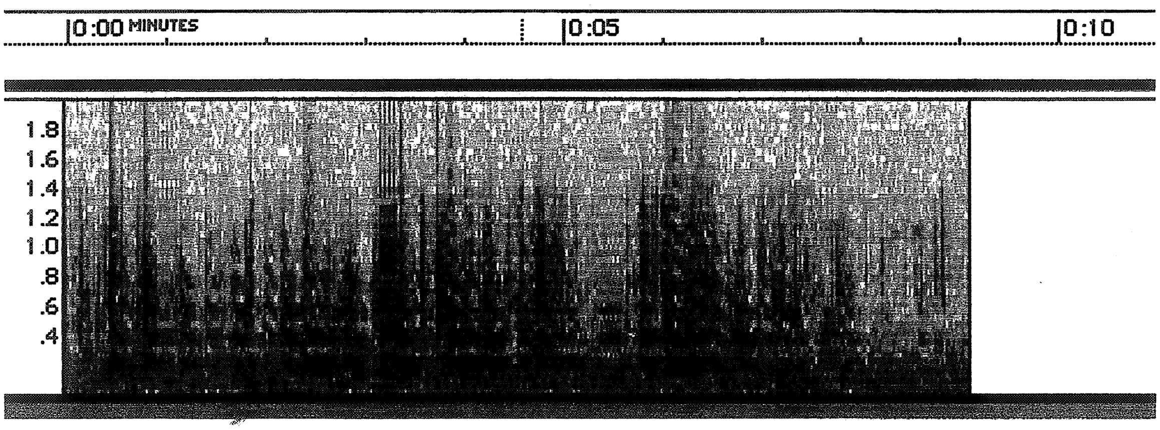

6/18/99 A good whistler followed by a couple of echoes.



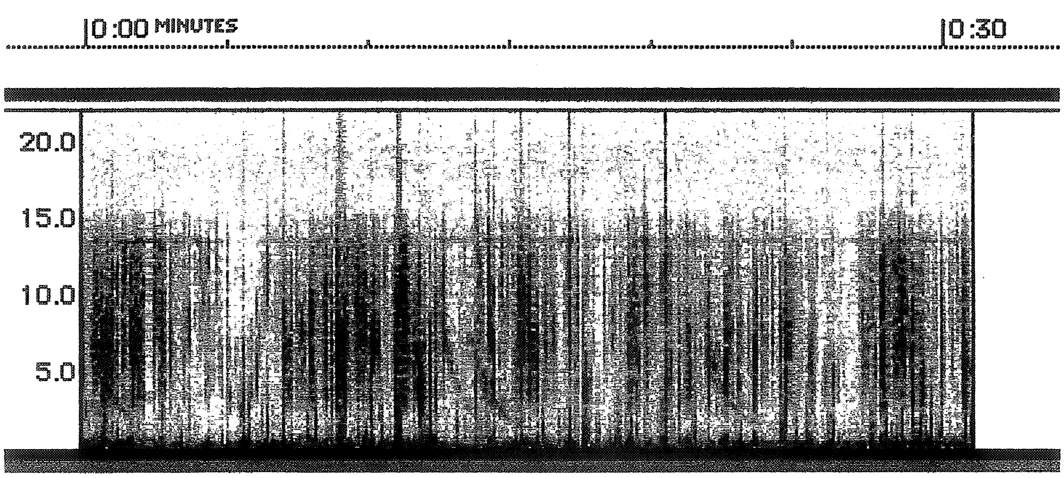

6/25/99 Tweeks on Trail Ridge Road. The arrow points to the start of a segment of the tape where the sound is slowed by a factor of 18.5. The result is an eerie sound.



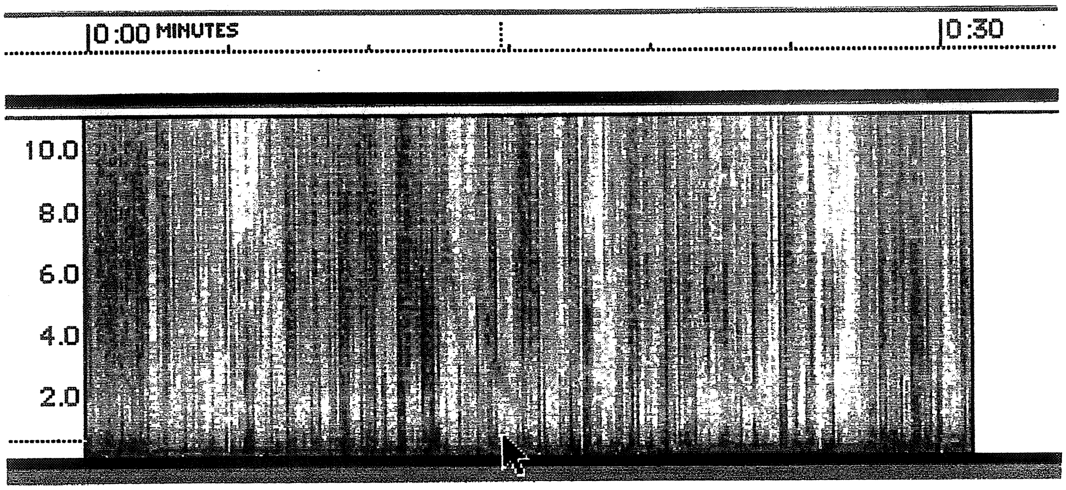

A 0-2 kHz view of the slowed tweeks. The arrow points to a burst of tweeks.



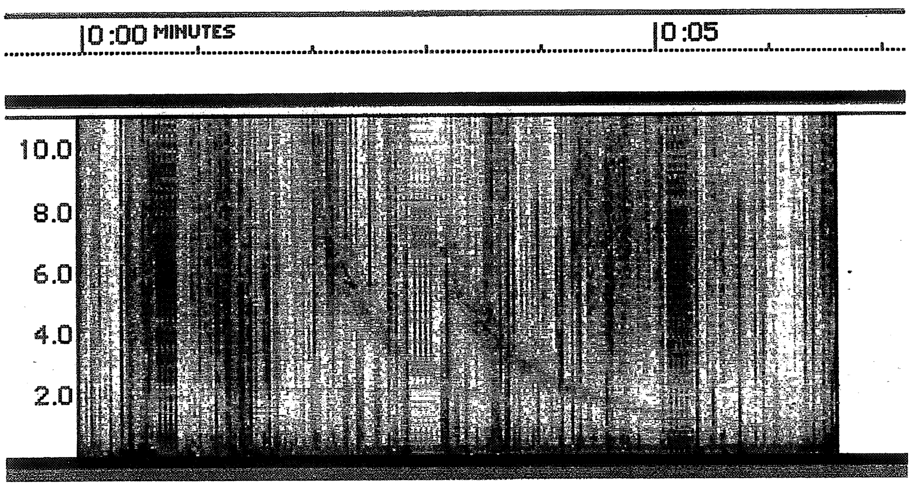

Nine seconds of the slowed tweeks. Actual time is about 0.5 seconds.
Note the drawn out "hooks" and harmonics.



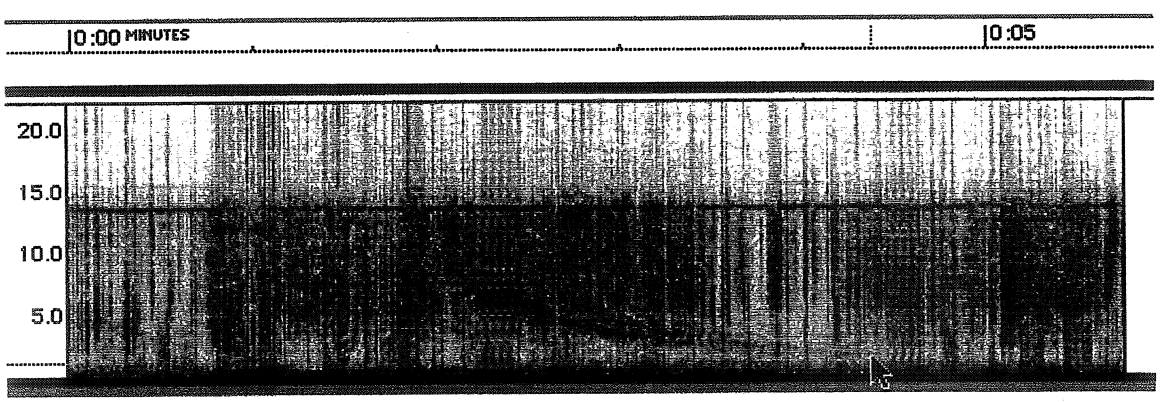

7/2/99 Mt. Evans. Several strong whistlers.



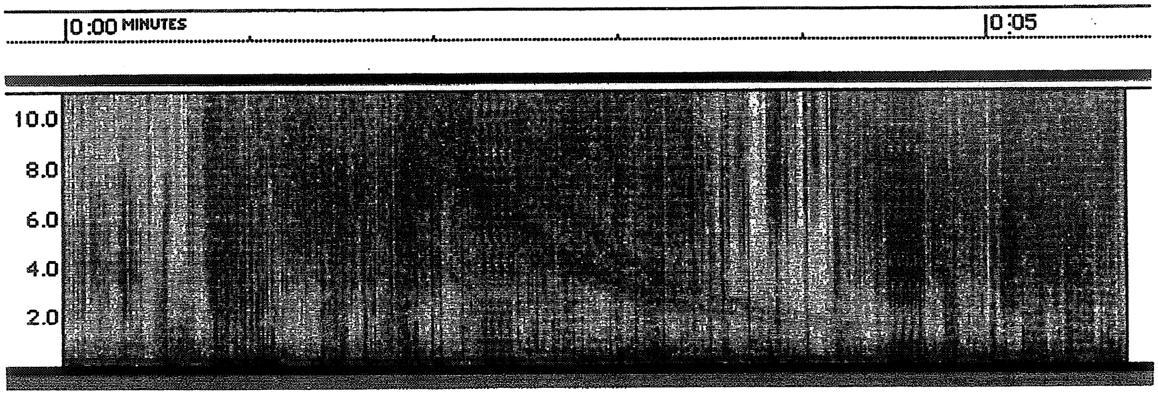

The same whistlers using a 0-11 kHz frequency range.



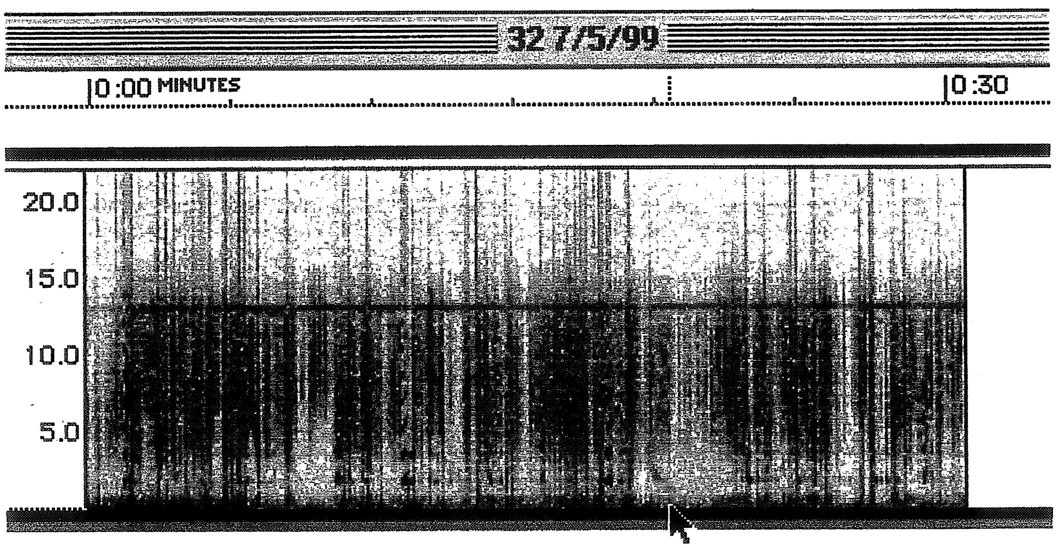

A close-up of the same two whistlers. They are not echoes, but rather two separate whistlers. The way to tell is that their slopes are the same. Notice how far down the second extends.



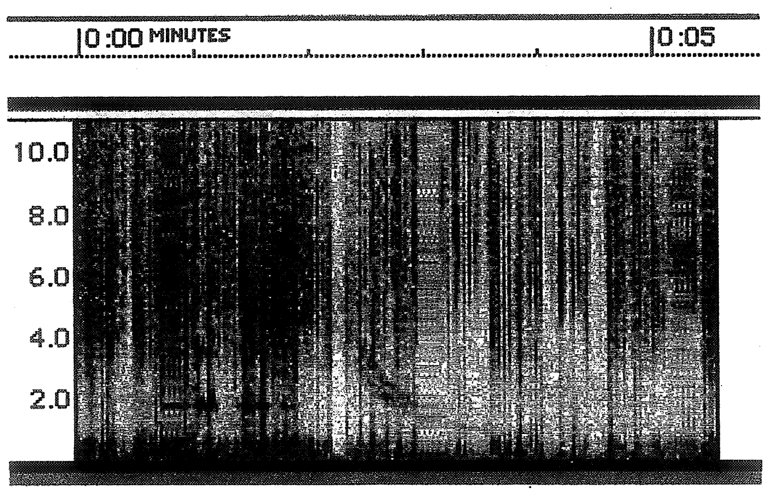

A long dispersion whistler.




The same whistler using 0-11 kHz frequency range. 8 kHz to less than 2 kHz in 2.5 seconds.




7/5/99 Trail Ridge Road Arrow points to prominent whistler that occurred during a lull in sferics following a burst of sferics and tweeks.




A close-up of the whistlers following a burst of tweeks.

## Team 7 Dean Knight Sonoma, CA
## Sonoma Valley High School

Dean and his students set up 3 RS-4 receivers with Bell and Howell Model 3185-A recorders and different antenna arrangements. Receiver "#62" uses a 145 foot long wire antenna oriented East-West. Receiver "#64" uses a 198 foot long wire antenna oriented North-South. Receiver "#65" uses a 91 foot longwire antenna oriented East-West. Sonoma Valley High School Team members are indicated below.

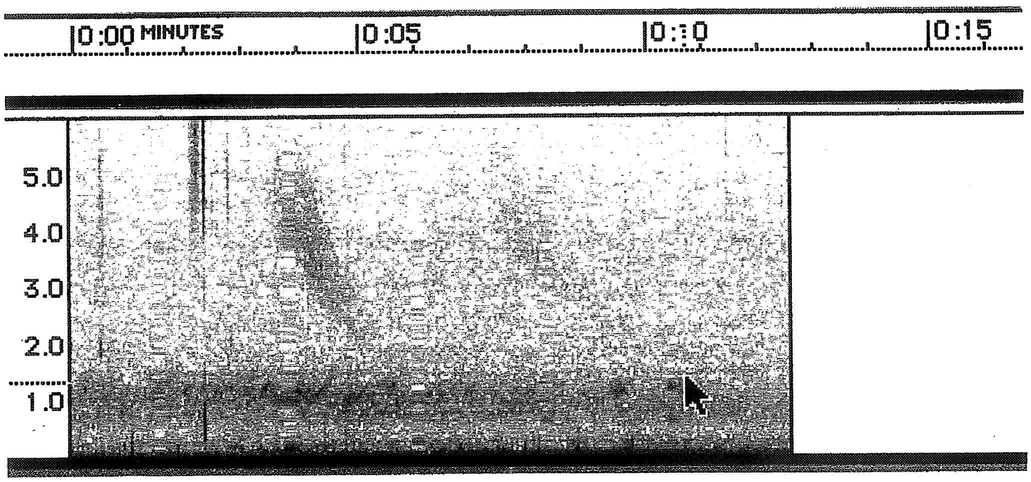
| | 21-2 | 21-6 | 28-4 | | 21-2 | 21-6 | 28-4 |
|---|---|---|---|---|---|---|---|
| Bret Allen | | x | | Kayla Egnew | x | x | |
| Chantelle Amontito | x | | x | Ashley Love Evans | x | | |
| Joey Ameroso | x | x | | Katie Everidge | x | x | |
| Sacha Bendayan | | x | | Steffen Guadeid | x | x | |
| Sean Brooks | | x | x | Kara Mazzo | x | | |
| Alex Cali | x | x | | Jenna Mendez | | x | x |
| Alex Chevillot | x | | x | Jeff Pitts | | | x |
| Lauren Clementino | | x | | Fernando Ramirez | x | x | |
| Alison DeWald | | | x | Bobby Shackford | | x | x |
| Jonathan Duff | x | | | John Shackford | | x | |
| Sara Devi | x | | | Rachel Smith | x | x | x |

## Team 30 Linden Lundback Watrous, Sask., CANADA
## Brian Cowan

Linden, along with teammate Brian Cowan, submitted this report.

> We were not able to record many of the sessions for this time period. Our observations on November 20, 1999, proved very interesting with many whistlers (some good) and a number of whistler chains that were quite dramatic. I think this was the first time we picked up good whistler chains where consistently timed echoes could be observed. A faint chorus was also heard on these tapes. November 27 sessions were quiet and uneventful. Our Ariel/Istochnik observations did not result in an audible signal discovery although we believe we had a visual of the station directly overhead at 00:57 UTC, which was a bit of a reprieve.
>
> In past newsletters, an example of each session (or nearly each session) has been included. That is good in my view but it would also be interesting to review the same time sample windows from a number of observers for a session that had generally good VLF activity. Our team would find it interesting to see any time differences in prominent sferics, whistler footprints, chorus phenomenon, etc, We were also wondering in particular who is using the VLF recording information and if any scientific enlightenments have resulted from this information.
>
> *[Editor's Note: What we need to have in order to get the cross comparison information you suggest is lots of listeners and some luck. We are certainly making progress on the first, and the second is only a matter of time. The number of experienced observers continues to grow and the quality of the observations is constantly improving with experience. In 1992, we had 11*

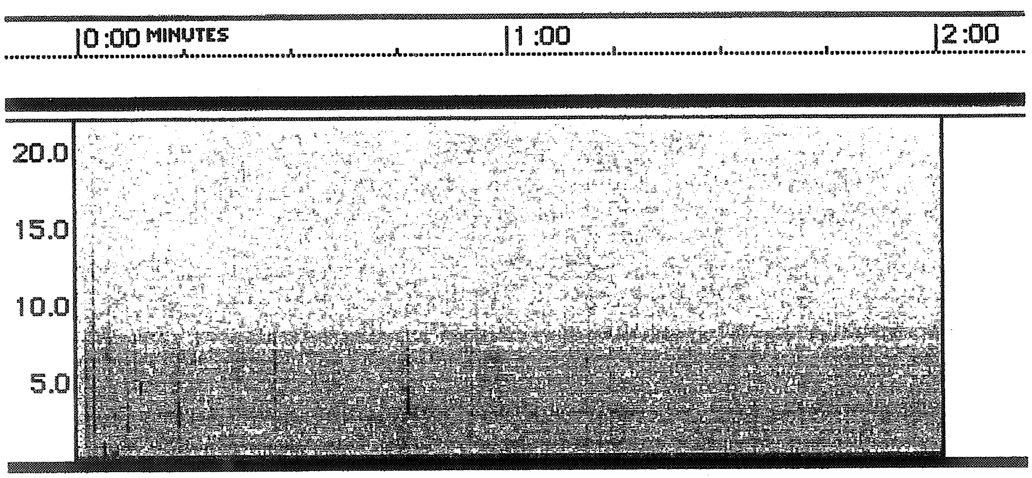
*observers from across the country record the same whistler (Big W) and we think that is the largest number of observers to record a single event.*
*As far as scientifically useful information from our observations, I can point to one, at least: we have demonstrated that the electron gun power of ISTOCHNIK is not sufficiently large to result in detection at the surface of the earth with our equipment. Planning is going on right now for proposals to have a similar instrument on the International Space Station that will have both more power and a frequency of operation that is higher and therefore farther above the powerline hum interference. If we ever get a positive result with ground observations, there are many space scientists who will be very interested in that.]*



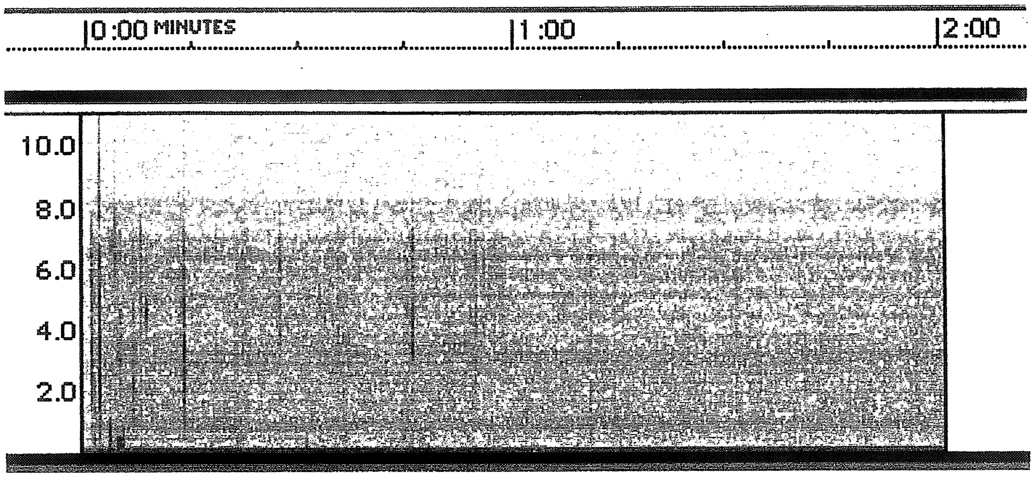

Whistler and echo logged on 11/20/99 at141415 UT

## Team AL Sara Scarritt Birmingham, AL

Sara is a student in Birmingham, AL, who built a VLF-2 receiver and made observations during the Leonid meteor shower in November 1999. The following is a sample from her tape starting at 01:43 CST.




0-22 kHz frequency range and very quiet conditions.



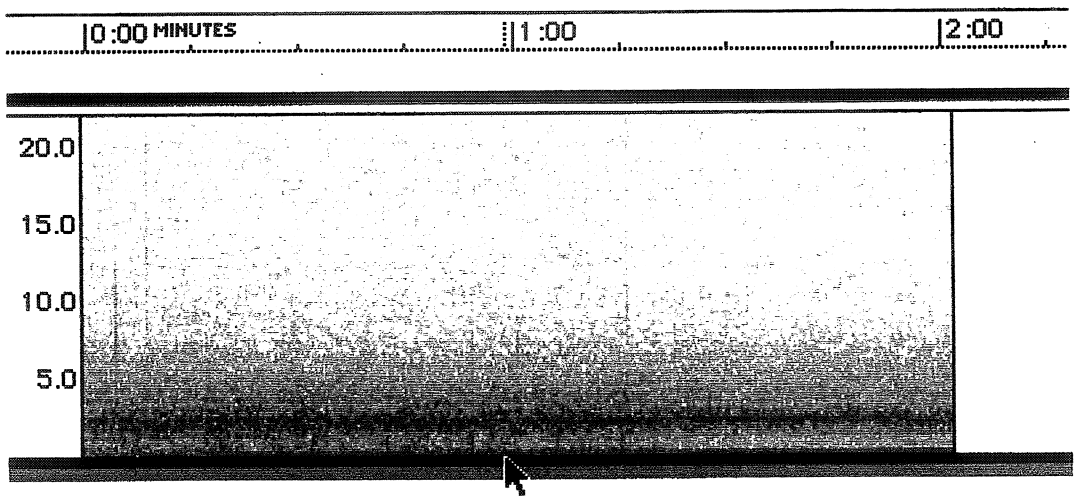

0-11 kHz frequency range.

## Team 31 Lee Benson Indianapolis, IN

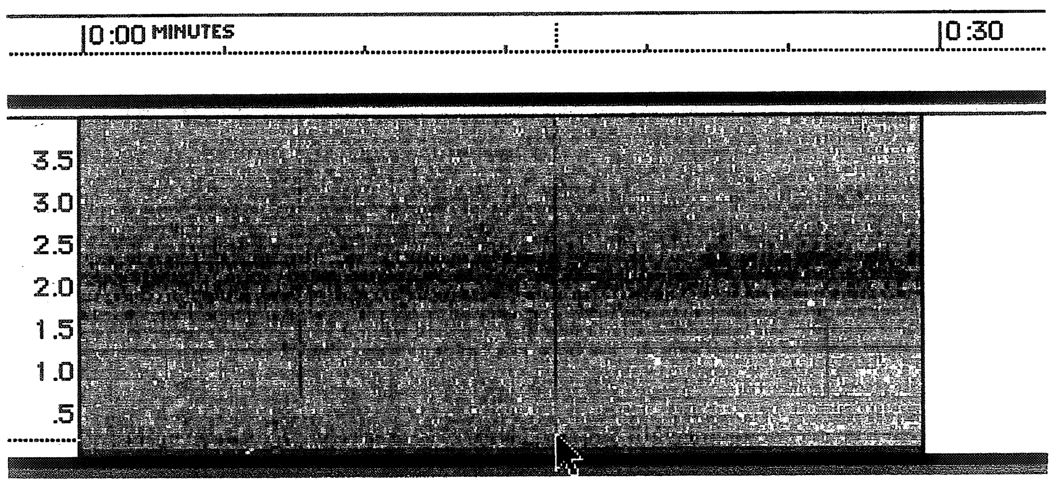
This week (11/8-12) I was in the Smoky Mountains (hills to someone from CA) *[Beautiful to this Californian who has been there! – Ed.]* and used the opportunity to be in a quiet place to do some UN-coordinated observing. Just before I left I happened to read a NASA news piece about an unexpected meteor shower (science.nasa.gov/newhome/headlines/ast05nov99_1.htm). I wasn't able to take all my equipment because I was at an environmental camp with 30 5th graders. I did manage to sneak in my McGreevey WR-3E and my tape recorder. I couldn't take my WWV radio because none of the kids could have them. I didn't get out until late evening (9:30 – 10:00 EST) but there were still in my estimation 10-15 meteors per hour visible from my location. I didn't get a very good ground on my tape so there was a lot of noise from it but that is very apparent on the tape and didn't seem to bother too much in the range of 6-10 kHz where most of the signals appeared. The signals are much different from those I recorded in April 99 in Indiana, especially in the second half. All the relevant information follows:

| | |
|---|---|
| Location: | Tremont, TN, S of Knoxville |
| | 36° 38.4'. 83° 41.3' plus or minus GPS error |
| Site: | Road side in a small valley surrounded by 1,000 foot ridges. |
| | Side of road with a clear view of the sky. |
| | Nearest power lines about 100 yards. |
| Meteors: | Observed 5 in the half hour. Longest track: 15° of sky. |

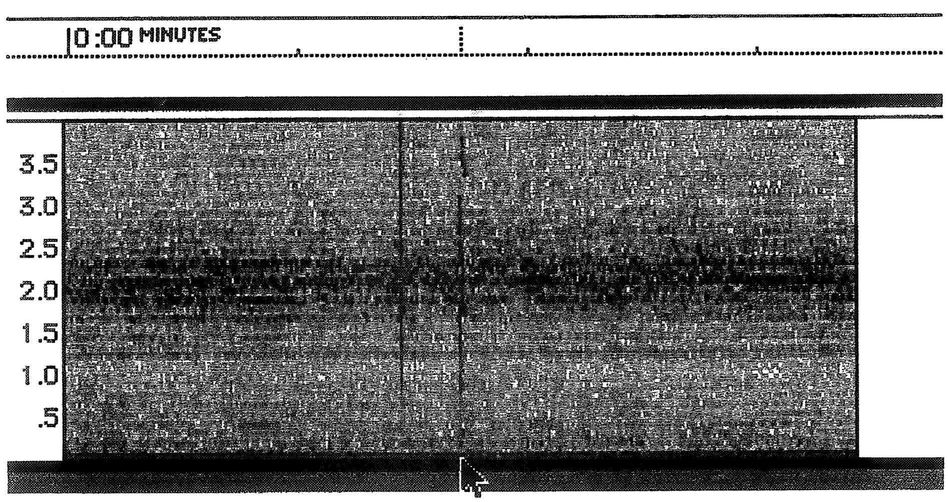
At the end of a session a cop almost ran me down. They apparently don't have many people listening to the solar wind at night around here. After our discussion I bet he knows more about the magnetosphere, the solar wind and plasma physics than all the rest of the force combined. I think I persuaded him I wasn't drunk or on drugs but I don't think I convinced him that I wasn't crazy.



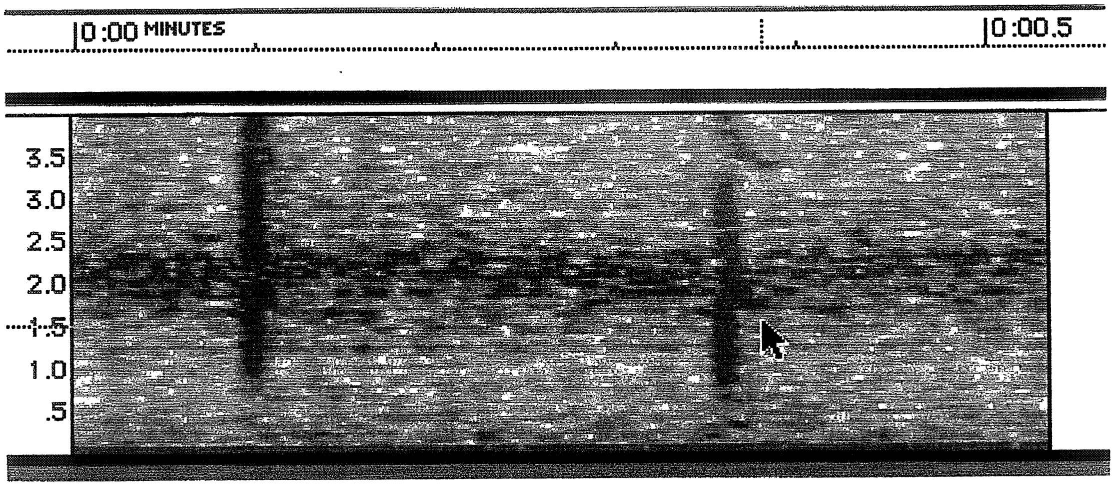

This is two minutes from the second half of the tape when things were running smoothly. The arrow points to a strong tweek.




This is the same tweek using a 0-4 kHz frequency range.




The tweek again in a 3.5 second time interval.




The arrow shows the tweek "hook" at about 1.7 kHz with a harmonic also present at 3.4 kHz. Tweeks are relatively common in the evening and through the night.

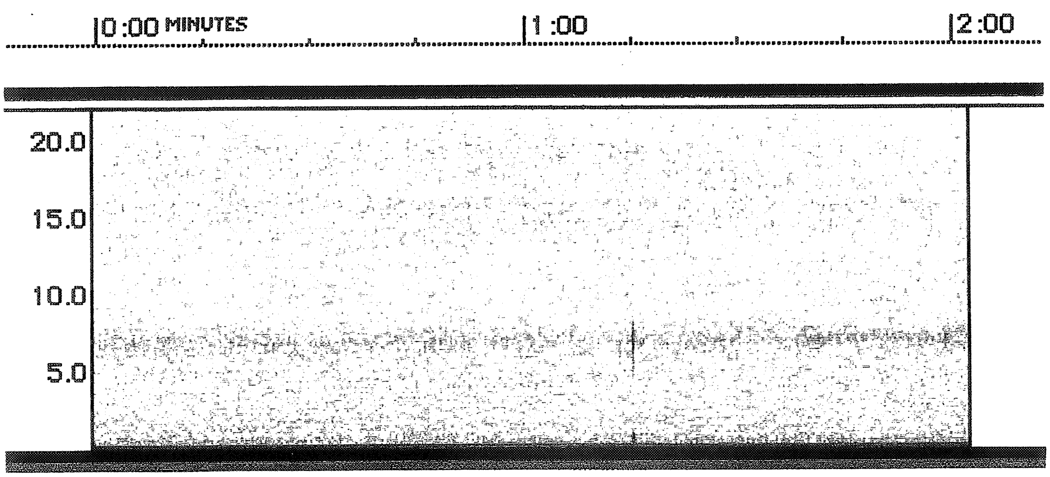
## Team UK John Hislop Ursuline College, Kent, England

In a note passed on by the INSPIRE UK Coordinator, Sarah Dunkin, John writes:

Side A has about 10 minutes of recording for the period before totality, about one half hour before.

Side B starts at midday French time (10:00 UTC) from the pips of the BBC World Service. The time of totality was 27 minutes later. The recording stops a few minutes after that – when we set off or the champagne!

I'll be surprised if there is any difference in the recordings. I received a poster from EUMETEOSAT that shows the moon's shadow moving across the Earth. It's such a small area that the ionosphere would hardly be affected. Anyway the experiment was worth trying!




Two minutes coinciding with totality. Very quiet conditions (and probably not due to the eclipse!).

Data Log Cover Sheet (copy as needed)

INSPIRE Observer Team ____________________ Receiver ________

Operation ____________

Date __________ Tape Start Time (UT) __________

*****************************************************************************

| | | | | | |
|---|---|---|---|---|---|
| Operation details: | Tape start time: | ________ | UT | ________ | local |
| | Operation start time: | ________ | UT | ________ | local |
| | Operation type: | __________________ | | | |
| | Operation stop time: | ________ | UT | ________ | local |
| | Tape stop time: | ________ | UT | ________ | local |

| | | | |
|---|---|---|---|
| Equipment: | Receiver | ____________________ | WW V reception: |
| | Recorder | ____________________ | ____________ |
| | Antenna | ____________________ | ____________ |
| | WWV radio | ____________________ | ____________ |

Site description: ________________________________________

Longitude: ____° ____' W Latitude: ____° ____' N

Local weather: ________________________________________

Personnel: ____________ ____________ ____________

____________ ____________ ____________

Team Leader address:

Name ____________________

Street ____________________

____________________

City, State, Zip, Country ____________________

INSPIRE Data (copy as needed)

INSPIRE Observer Team ____________________ Receiver ________

Operation ____________

Date __________ Tape Start Time (UT) __________

************************************************************************

Code: S - sferics 0 1 2 3 4 5 M - Mark T - tweek W - whistler O - OMEGA C - chorus
L M H

| Time | Entry | | Observer |
|---|---|---|---|
| ________ | ______________________ | S: 0 1 2 3 4 5 | ________ |
| ________ | ______________________ | S: 0 1 2 3 4 5 | ________ |
| ________ | ______________________ | S: 0 1 2 3 4 5 | ________ |
| ________ | ______________________ | S: 0 1 2 3 4 5 | ________ |
| ________ | ______________________ | S: 0 1 2 3 4 5 | ________ |
| ________ | ______________________ | S: 0 1 2 3 4 5 | ________ |
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